SCIENTIFIC AMERICAN

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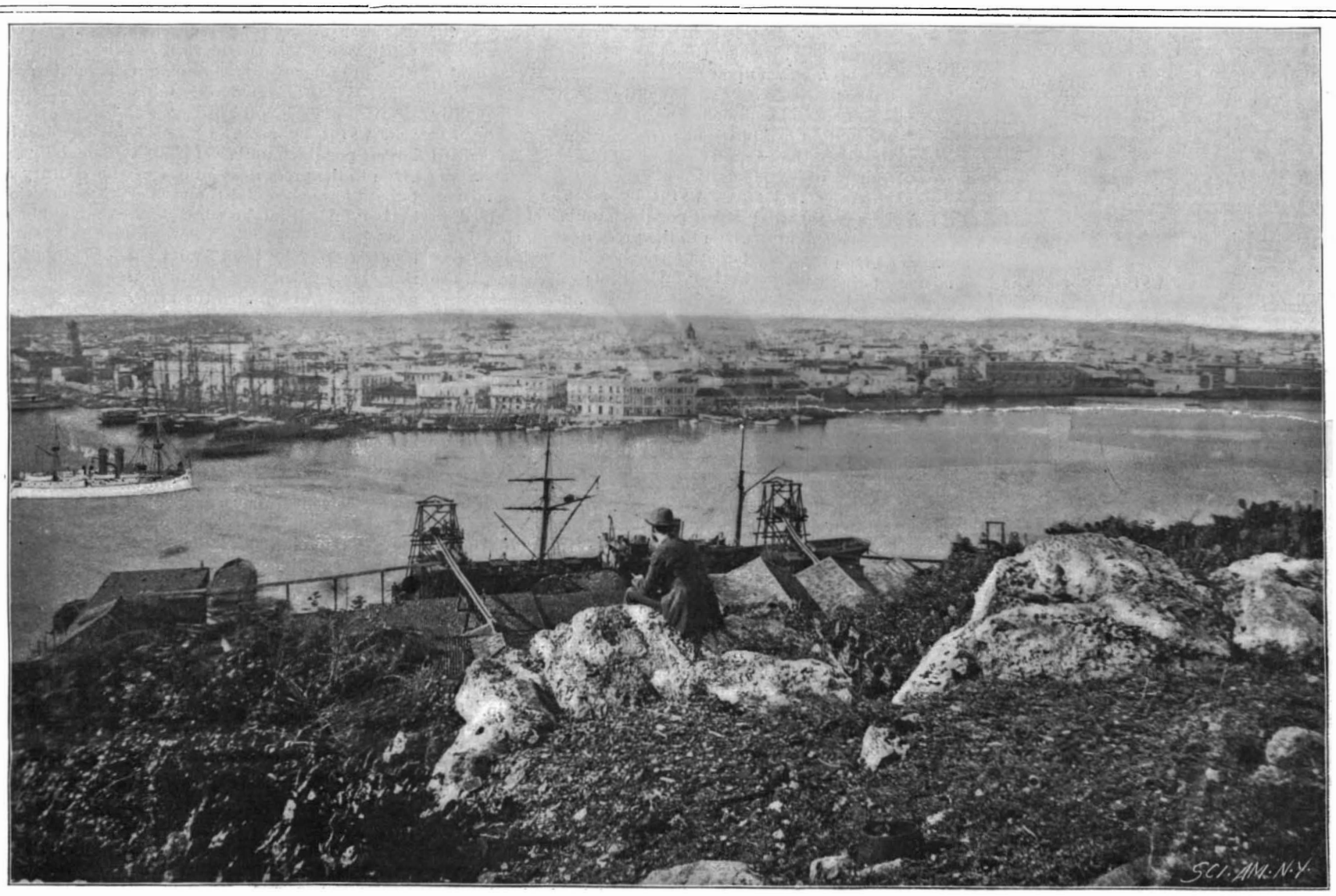
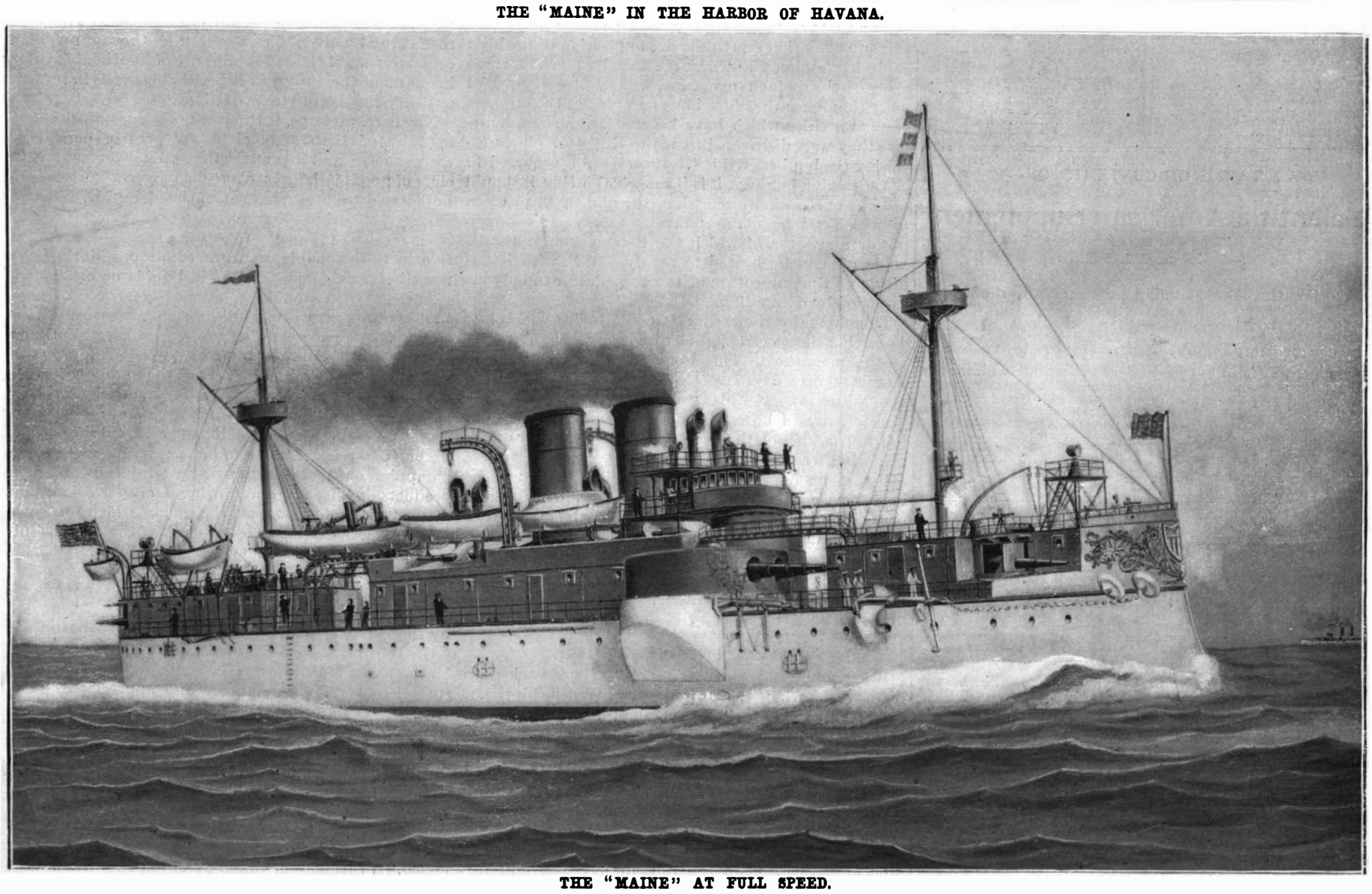


THE "MAINE" IN THE HARBOR OF HAVANA.



THE "MAINE" AT FULL SPEED.

THE LOSS OF THE BATTLESHIP "MAINE."—[See page 133.]

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THE DISASTER TO THE "MAINE."

The great calamity which has befallen the nation in the loss of one of its finest ships, with over two hundred and fifty of its brave and ever popular blue jackets, has brought mingled feelings to the hearts of the American people, feelings in which bewilderment and deep sorrow predominate. The perplexity and anguish which such marine disasters produce are here intensified by the extraordinary coincidences of time and place which render the loss of the "Maine" suspicious and grimly suggestive. In view of the strained relations existing between the Spanish government and our own, and having fresh in mind the inexcusable incident of the De Lome letter, the American people were fully justified in their first exclamation of "Treachery!" when they learned that their warship had been blown up at the dead of night in a Spanish harbor.

Self-control and moderation, however, are frequently the highest exhibition of courage, and, after the first shock of the calamity was passed, the public realized that it would be fatal to make charges of crime in the absence of any proof that a crime had been committed. It was felt that the timely suggestion contained in the dispatch from the captain of the ship, that judgment be suspended, must be followed.

Theory is rife as to the cause of the disaster. If the vessel was struck by a torpedo, the effect would have been the bursting in of her underwater plating, accompanied by a dull, muffled roar. It is claimed that, as the action of high explosives is chiefly downward, the explosion of the gun-cotton charge in the head of a torpedo would not produce sufficient shock to detonate the explosives within the magazines. We are of the opinion that if a torpedo or mine exploded immediately in the vicinity of the magazines, the shock would be quite sufficient to detonate its high explosives. It is true that the "Blanco Encalada" was struck and sunk without any concurrent explosion of her magazines, as were other ships before, and since in the China-Japan war, and this fact is pointed out by those who scout the idea that the "Maine" was lost in this way.

If the explosion was due to causes within the ship, it was either intentional or accidental. That any agent of either Spain or Cuba could have placed explosives within the ship, either in coal bunkers or magazine, is rendered extremely unlikely by the extra precautions which would be taken to safeguard the ship. The magazines themselves were inspected at eight o'clock that night, or only about an hour and a half before the explosion occurred, and the keys were hanging at the time in the captain's stateroom. The coal in the bunkers had been brought from home ports, and it is stated that only necessary supplies in the way of provisions had been taken on day by day in the harbor.

The accidental causes may have arisen from fire, due to spontaneous combustion of coal in the bunkers, or from a short-circuited electric wire, or there may have been an explosion due to the decomposition of the high explosives on board. There are coal bunkers on three sides of the 10-inch magazine, and it has happened more than once that fires have occurred in the bunkers of our warships which have become fierce enough before they were discovered to make the steel plates inclosing the bunkers red hot. If such a fire occurred in the adjoining bunkers, it is inconceivable that it should not have been discovered when the nightly inspection, to which we have referred, was made. The brown powder, however, of which the 10-inch ammunition is made up, can be heated to nearly 600° F. with impunity, and the gun-cotton of the torpedoes can only be exploded by detonation.

There remains the theory that the boiler which was supplying the electric light dynamos exploded, and set off the magazines. This would fully account for the double reports spoken of in many of the accounts by eye witnesses. If this was the first cause of the disaster, it will be a difficult matter to prove from the appearance of the wreck whether the boiler or the magazine was the first to explode.

It is to be hoped that every possible effort will be made to clear up this terrible mystery. Officers and men alike will want to know whether the death-dealing contents of their ships are subject to laws which are thoroughly understood, or whether they walk above a sleeping volcano which may hurl them unwarned to a death whose actual cause may never be ascertained.

WEATHER BUREAU WARNINGS.

It is likely that if the average citizen were asked to define the work of the United States Weather Bureau, he would say that it consisted in taking observations of the weather and in affording protection to shipping interests by giving due warning of impending storms.

As a matter of fact, however, the work of this bureau is felt over a far larger field than is included under the term "shipping interests," and its range of observations takes in a much wider variety of subjects than the public generally supposes. It is true that the captains of vessels consult the bureau forecasts and frequently defer their sailings as the result of its warnings; but this represents only a portion of a great system of meteorological forecasts which are directed to the protection of life, property and merchandise both on land and sea.

What might be called the protective work of the bureau is felt in every community throughout the country. It safeguards the crops of the farmer and the fruit grower; warns the shipper of perishable goods of the approach of hot or cold waves, and tells him how long to keep his merchandise under shelter and when it is safe to let it go forward; gives timely warning to the railroads of the approach of storms which will probably call for emergency work with snow plows, special engines and crews; and by its timely warnings throughout the country probably preserves an amount of merchandise from destruction, damage or delays which would compare in bulk with that which is carried out of our various shipping ports on the coast.

The Weather Bureau disseminates its daily prognostications of cyclones, hurricanes and storms and hot or cold waves by means which insure its reaching the largest possible number of people. The daily report is given to the press associations of the country and its bulletins are posted at the various bureau stations and in thousands of public places where they will be readily accessible to the public. So complete is the distribution that it would be difficult to find a regularly recurring item of daily news which is more accessible or more widely distributed than this.

In the event of the approach of a hurricane along the coast warnings are sent to all port stations, from which signals are displayed, flags being used by day and lanterns by night. General information is sent to all shipping interests and bulletins are posted at the maritime exchanges giving full notification of the position and movement of the storm. By the co-operation of the shipping interests, the steamers leaving the port of New York or any ports at which the warnings have been received display the signal flags of the bureau for the benefit of coastwise or inward bound vessels. All foreign maritime exchanges receive cablegrams from this country relative to the movement of ocean storms, their course and probable duration, and this information is posted at the various exchanges and custom houses, so that commanders or masters leaving foreign ports are prepared to encounter conditions according to the warnings given.

Similar care is exercised by the Weather Bureau over the internal mercantile interests of the country. In addition to the usual forecasts, special warnings are sent out at the approach of any storm of unusual severity. Thus the railroad companies are warned of coming snowstorms in time to enable them to overhaul snow plows and gather together the necessary crews for "fighting snow." Special engines are held ready with banked fires, and men are distributed to keep the switches, signals, etc., clear of snow, so that when the storm breaks it finds, thanks to the bureau, an organized equipment ready for all emergencies. The railroads are also given due warning of the approach of cold waves, and these bulletins are of inestimable value in enabling them to protect perishable goods in transit, or hurry them on to their destination.

Nowhere, perhaps, is the work of the bureau better appreciated than among the shippers of perishable merchandise, and it is a fact that the movement of this class of goods is largely controlled by the forecasts of hot or cold waves. We are informed by Mr. Elias B. Dunn, the local weather forecaster, that he is in constant receipt of inquiries from shipping merchants relative to the probable weather conditions during the transit of consignments of fruit, liquids or other commodities which would be injuriously affected by extremes of temperature. This particular feature of the service is of great value in the port of New York, especially in the fruit and kindred trades. A forecast of extreme cold will sometimes cause the hatches of a vessel to be kept closed for several days, and the work of the bureau results in the annual saving of many thousands of dollars worth of merchandise in this particular branch of trade. Mr. Dunn has placed in our hands a pamphlet entitled "Temperatures injurious to food products in storage and during transportation, and methods of protection from the same," which was compiled by H. E. Williams, chief clerk of the forecast division, to supplement the work of the bureau in this direction. It contains a list of eighty-four perishable goods, and opposite each item is recorded the temperatures which it will stand without injury when protected by the various systems of packing and transportation.

Of the direct benefits of the bureau forecasts to the farmer and the fruit grower it is almost superfluous to speak—so well are they known and appreciated. The fruit farms of Florida and California, the sugar plantations of Louisiana and Texas, and the truck growing interests of the eastern seaboard, are not slow to express their indebtedness to the warnings received from the bureau. The San Francisco office reports that during the last three years not a single rain occurred in the raisin drying region without warning, and that in only one instance was an unnecessary warning issued. If this may be taken as a sample of its efficient work in a single department, we may form some idea of the far-reaching benefits of this deservedly popular ser-

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vice when we bear in mind that during the past year over 50,000 forecasts and special warnings were distributed in the various States and Territories of the Union.

REPORT OF THE SMITHSONIAN INSTITUTION.

The report of Prof. S. P. Langley, Secretary of the Smithsonian Institution, for the year ending June 30, 1897, has just come to hand. The secretary gives an account of the financial condition of the institution, which shows that the total receipts of last year were $62,528.71, the disbursements being $58,061.99. During the year 1896–97 Congress charged the institution with the disbursement of the following appropriations:

International exchanges	$19,000
North American ethnology	45,000
United States National Museum:	
Preservation of collections	153,225
Furniture and fixtures	15,000
Heating and lighting	13,000
Postage	500
Repairs to buildings	4,000
Rent of workshops	2,000
Galleries	8,000
National Zoological Park	67,000
Astrophysical Observatory	10,000

The Secretary states that his time must be almost wholly given to administrative affairs, yet, as in years past, he continues his investigations begun prior to his connection with the institution, so he has devoted such time as he could spare to researches on the solar spectrum and to experiments in connection with certain physical data on aerodynamics. He says that both of these investigations have reached a point at which it is possible to give somewhat full statements of the results. He states that since the successful trial of the mechanism built of steel and driven by a steam engine which made two flights each of over half a mile on May 6, 1896, a third and much longer flight was made on November 28, 1896, with another machine built of steel, like the first, and driven, like that, by propellers actuated by a steam engine of between one and two horse power, making a horizontal flight of over three-quarters of a mile and descending in safety. Prof. Langley says: "I have thus brought to the test of actual successful experiment the demonstration of the practicability of mechanical flight which has been so long debated and till lately so discredited. To satisfy a nearly universal interest, I am now engaged in the preparation of a full description of these experiments since 1891, when my first memoir on aerodynamics was published. This memoir, with those on 'Experiments in Aerodynamics' and 'Internal Work of the Wind,' will form volume 27 of the Smithsonian Contributions to Knowledge, which will thus contain a complete record of all experiments carried on thus far under my directions on this subject." This is certainly very important news, and the volume will be looked for with great anxiety by those who are interested in the problem of aerial flight.

The Hodgkins medals of award were received at the institution in July, 1896, and were transmitted to those competitors for the Hodgkins fund prizes who were recommended by the committee to receive medals. In July, 1896, E. C. C. Baly, of University College, London, a Hodgkins competitor, was awarded a grant of $750 to enable him to prosecute further his investigations on the decomposition of the atmosphere by means of the passage of the electric spark. A report of the research so far as it has progressed has been received. An additional grant has been made to Dr. S. Weir Mitchell and Dr. J. S. Billings for investigations which have been conducted in the laboratory of hygiene of the University of Pennsylvania, upon the effect which a prolonged exposure to vitiated air has upon the power of individuals to resist infectious diseases. From the result obtained it would appear that we have here an important confirmation of the clinical observation that tuberculosis thrives most in vitiated air. The six Hodgkins memoirs have been published by the institution, and a copy of each was sent to all persons who had submitted papers in connection with the competition.

The Smithsonian Institution has renewed the lease of the Smithsonian table at the zoological station at Naples for a second term of three years. Ethnological and natural history explorations have been continued under the direction or with the assistance of the Institution in various parts of the world by the Bureau of Ethnology and the National Museum, resulting in the addition of a large number of objects of interest from various parts of the world to the museum collections, and much valuable information has been acquired regarding the history and the language of the American Indians.

The publications of the Institution and its bureaus during the year comprise two works in quarto form, four in royal octavo and fourteen in octavo, aggregating 9,630 pages, covering, to a greater or less degree, nearly all branches of human knowledge.

Two memoirs in the "Contributions to Knowledge" series were issued during the year, both having been submitted in competition for the Hodgkins fund prizes; one being a memoir by Prof. Rayleigh and Prof. Ramsay, describing the discovery of argon, for which achievement the authors were awarded the first Hodgkins prize of $10,000. The second was a memoir of Prof. E. Duclaux, of Paris, entitled "Atmospheric Actinometry and the Actinic Constitution of the Atmosphere." Nine papers of the miscellaneous series were issued, including "Physical Tables" by Prof. T. Gray, "Mountain Observatories" by E. S. Holden and "Recalculations of Atomic Weights" by Prof. F. W. Clarke and others. "The Catalogue of Scientific and Technical Periodicals" by Dr. H. Carrington Bolton is in type and will soon be published. It comprises titles of more than 8,500 scientific and technical periodicals in all languages, adding about 3,500 titles to the first edition published in 1885. There is also completed, ready for the printer, a voluminous supplement to Dr. H. Carrington Bolton's "Select Bibliography of Chemistry."

The "Annual Report" is in two volumes, one of which is devoted to the National Museum. In the general appendix of Part I. are included memoirs of all branches of knowledge, selected chiefly from publications of learned societies of the world which are not readily accessible to the public, the basis of the selection being that the papers are written by a competent person, give an account of some important or at least interesting scientific discovery, are untechnical in language and suitable to nonprofessional readers. The secretary also refers to "A History of the First Half Century of the Smithsonian Institution." We have already reviewed this book at considerable length.

The library continues to grow steadily; the increase in volumes, parts of volumes and charts reaching 35,912 during the past year. The Secretary refers to the committee which met at London, in July, 1896, to direct the preparation of a catalogue of scientific literature. The secretary recommends that an appropriation be made to the Smithsonian Institution of $10,000 per annum to cover the cost of cataloguing the American publications. The Department of State has agreed to submit an item for this purpose for the year 1898–99. The east stack of the new library of Congress has been assigned for the Smithsonian collection of transactions. The institution's deposits now number over 250,000 titles.

The Secretary also refers to the important divisions of the Smithsonian Institution, the National Museum, the Bureau of American Ethnology, the International Exchange Service, the National Zoological Park and the Astrophysical Observatory. On the whole it is remarkable to see what an amount of good is done by the diffusion of human knowledge directly resulting from the bequest of a single man.

FLAMES IN A TALL BUILDING.

The effects of fire in a tall fireproof building have been anxiously discussed by both firemen and architects. The fire which occurred February 11, in Nassau Street, near Ann Street, New York, gave the first opportunity that has ever occurred in New York for the study of an outside fire working on a tall building. Chief Bonner declares the spot is the most dangerous acre in the city. The block is surrounded by narrow streets, resembling those in London, and the buildings are old and filled with inflammable goods. The Vanderbilt building has a frontage of eight stories on Nassau Street, and the Beekman Street annex rises to fifteen stories, being 40 feet wide. Two rows of offices in it, each 16 feet wide, open on each side of a 6-foot hallway. The building lacks some of the modern improvements, for instance, the outer ledges of the windows are of wood. The fire did not give the most severe possible test, as it was 150 feet away from the south wall.

The building which was destroyed by fire is what is known as Nassau Chambers. It was a small office building filled with combustible material, and when the fire once started there was no hope of saving the building or its contents. It was like a volcano, and, owing to the strong wind which was blowing, particles of paper and cinders were carried to the distance of half a mile, and the square in front of the post office was hardly passable, owing to the shower of burning matter. The scene was spectacular in the extreme, and was visited by many thousands of people. A short time after the flames burst from Nassau Chambers the window ledges and frames of the ninth, tenth and eleventh stories of the annex of the Vanderbilt building began to throw out little jets of flame. This was a little after seven o'clock. It was eight o'clock before the firemen got into the burning floors of the Vanderbilt building. The elevators were not running. This was unfortunate in itself, as with elevators it is possible to take up hose without the slightest loss of time, and many valuable minutes may be saved. The firemen started up the steps with the hose and at the sixth story fell exhausted, and some reporters and a fireman carried the load up the final three stories. By the time the ninth floor had been reached, the fire had broken through the windows and was tossing masses of flame into the four offices in the southwest corner of the annex. The firemen connected the butt of the rear section of the hose with the building water pipes, and walked in toward the fire. The heavy frescoed cornice fell with a crash, narrowly escaping the head of a fireman. It was the matter of only a few minutes to put out the fire after the water began to flow.

A reporter of The New York Times, who was watching the behavior of the fire on the building, made a trip through the building. At the tenth floor, the glass panels of the doors of three offices nearest the corner were so hot that they burned the hand. On the eleventh floor, the panels were nearly as hot. On the twelfth floor they were only warm. In four or five minutes the panels of the tenth floor were shivered, fire bursting through these openings in an instant, catching the wood cornice in the halls and sweeping along eastward. In a few minutes another squad of firemen were on the floor and additional hose having arrived, the work of putting out the fire was begun. The smoke by this time was so thick that the men were gasping for breath. From one of the north windows it appeared that the men were standing in an oven with the fire above and below them. The walls did not warp, but the kalsomine fell from the ceilings. The wood casings of the floor were burned to the tiles beneath. Desks, shelvings, cornices and window ledges and sashes were destroyed. The structure itself did not show the slightest sign of injury, except the crumbling of the face of some of the bricks where they were attacked both by fire and water. Not a drop of water leaked to the floor below; the flames never broke through the ceilings, except in one place where a steam pipe came through. In fact, on the tenth floor the fire was pretty well spent before water was put on it. The wood work had been consumed and the structural part of the building was left intact. The reporter who was on the eleventh floor when the fire burst through the office doors into the hallway walked to the last office on that hallway and back to the head of the steps to prove that anybody in those offices could have gained the stairway with safety. The fire outfit of the building itself also contributed toward controlling the fire, for its tank and pumping engines furnished to the firemen 26,800 gallons of water, according to the meter in the building. This was supplied through the stand pipes of the building, which reach to the top floor and have fire plugs on each floor.

The data thus obtained by the fire in this building throws some light upon the danger to life in a modern high office building. The fire had practically unrestricted play on three stories for an hour, and not a wall or ceiling gave way. The results of the fire show that wood around windows should be avoided and every window which faces a court should have iron shutters, which should be kept closed at night and which could be readily closed in the daytime in case a fire occurred in surrounding buildings. The highest stories of the Vanderbilt building are unprovided with iron shutters.

SUCCESSFUL TEST OF PNEUMATIC POSTAL TUBE.

An important branch of the pneumatic postal tube service which is being installed in this city has been successfully tested by the Post Office authorities. The line runs from the General Post Office to branch station H, in the Grand Central Palace, at Lexington Avenue and Forty-third Street. It is three and a half miles in length, and consists of two parallel lines of 8-inch tubes which are laid from three to eight feet below the surface of the street. The mail is conveyed in "carriers," —cylinders of plate steel seven inches in diameter and two feet long—which have a capacity of about 600 letters each. The carriers are impelled by a current of air which is driven continuously round the circuit, starting from the compressors at seven pounds to the square inch and exhausting at the end of the system at about atmospheric pressure. The carriers are supported in the tubes by two packing rings, which serve to secure an airtight contact. The average speed of the carriers is about 30 miles per hour, but this may be increased by raising the pressure.

A fully illustrated description of the system will be found in the SCIENTIFIC AMERICAN of December 11, 1897, with a map showing the route of the two lines now in operation and also of those which it is proposed to lay down in the near future. The section which has just been opened is laid along Center Street and Fourth Avenue, and in connection with the section already in operation from the General Post Office to the Produce Exchange, it provides a continuous section about four miles in length.

The test was witnessed by Second Assistant Postmaster-General Shallenberger, Postmaster Van Cott, and several members of the House Committee on Post Offices and Post Roads. The carriers traveled between the two stations, a distance of 3½ miles, in 7½ minutes, and an answer to a dispatch sent from the General Post Office, Park Row, to the Hotel Manhattan, at Forty-second Street and Madison Avenue, was received in exactly 37 minutes by the new route. The proposed extensions of the system include a line across the Brooklyn Bridge and two additional north and south lines from the General Post Office to One Hundred and Twenty-fifth Street, with a cross connection on the latter thoroughfare.

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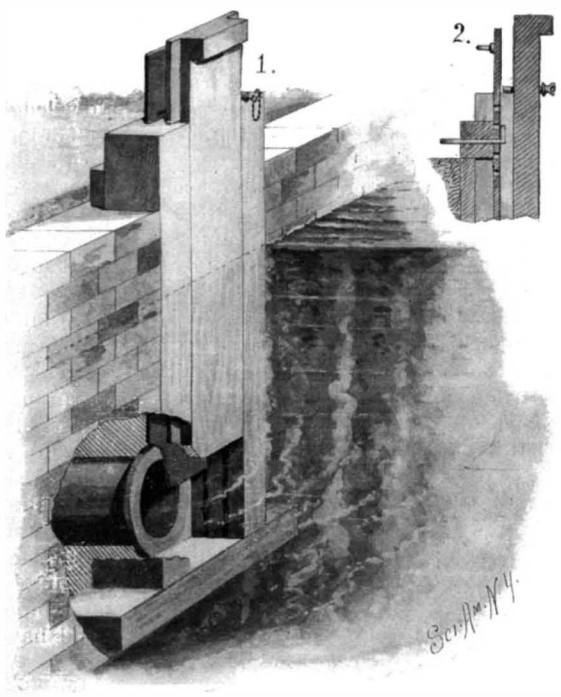
A HEAD GATE FOR IRRIGATING CANALS, ETC.

In sections of the country where the water from expensively constructed ditches or canals is sold for irrigating purposes, etc., it is of great importance that the seller shall be at all times able to limit the quantity supplied to each individual consumer, in order that all purchasers may receive their due supply; but as such supply is sometimes greater than is needed, it is also important to afford the purchaser means for cutting off the flow of water to his lands as desired. To attain these ends the head gate shown in the accompanying illustration has been invented and patented by Ignatius D. O'Donnell, of Billings, Montana. The back of the head gate is closed, as indicated by the broken away portion of the engraving, a pipe leading to it from the irrigating ditch, and in the sides of the gate frame are slideways in which the main gate, preferably of metal, moves vertically, resting upon the bottom sill to form a watertight closure, when the water

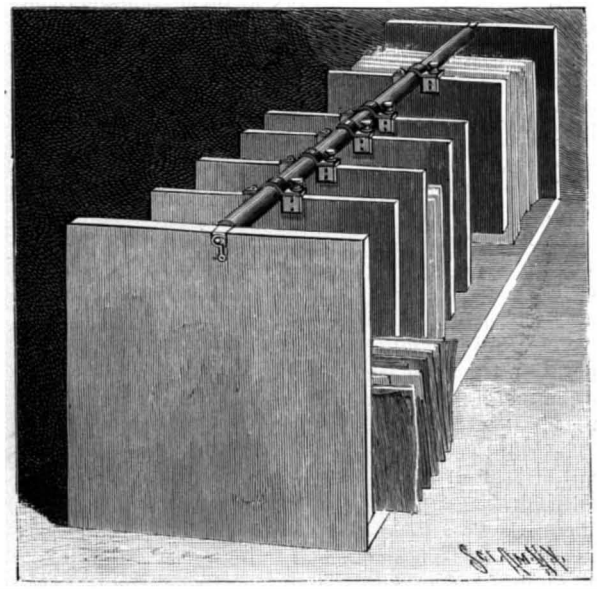


O'DONNELL'S HEAD GATE.

is to be cut off. In the upper portion of the gate are openings, by passing a latch through one of which the gate may be held at different distances from the bottom, to regulate the supply of water, the latch being adapted to be locked, and so arranged that it cannot be withdrawn from the outside or back portion of the frame, as indicated in the small sectional view. In addition to this gate an individual gate is provided, to be used only by the consumer, the latter gate sliding to closed position by its gravity, and being held at the desired elevation by passing a pin through one of a series of openings in the gate and into the frame. The arrangement is such that access cannot be gained to the locked latch bar of the main gate while the individual gate is in the frame, nor can the latch bar be removed, the main or company gate being set and locked after the amount of water to be sold and supplied has been measured and agreed upon, although the customer may at any time cut off as much of the flow as he may wish.

A CONVENIENT DOCUMENT FILE.

To facilitate holding in order, compactly placed and readily accessible, letters, bills, general office docu-



DERBY'S DOCUMENT FILE.

ments, etc, the simple and comparatively inexpensive device represented in the accompanying illustration has has been patented by Richard C. Derby, 138 Bellevue Avenue, Newport, R. I. Supported on the end uprights is a removable rod, whose ends are angular to prevent its turning in the correspondingly shaped notches of the supports, to which the rod is held by a hook at each end. Suspended from and slidable along the rod are a number of movable partition pieces, in the upper ends of each of which is a semicircular portion to engage the lower side of the rod, while a clamp plate pivotally connected to the partition piece has a semicircular portion to engage the upper side of the rod. One end of the clamp plate has an opening through which extends a lug from a plate secured to the partition piece at one side of the rod, a pin being passed through an opening in the lug, while the opposite end of the plate is secured in position by a thumb screw. The thumb screw engages a tapped hole in a plate secured to the partition piece at the other side of the rod, and on loosening the thumb nut the partition piece may be readily moved along the rod, to be tightened and held rigid, by means of the thumb nut, against letters and documents placed in the file, the partitions being moved closely against the documents, etc., to hold the latter in compact order.

Varieties of Cardamom.

At the annual session of German naturalists, which has just been held, Dr. Niederstadt, of Hamburg, spoke on this theme and stated that two varieties of cardamom are known to occur in commerce, namely, the small or Malabar cardamom and the long or Ceylon cardamom, both derived from Elettaria cardamomum. The wild cardamom which comes from Borneo is without importance. Besides, various other varieties are put on the market—the Siam cardamom, from Amomum verum and rotundum, and the wild or bastard cardamom, resembling the Malabar cardamom, which is said to be derived from Amomum xanthioides. This variety has met with a decided refusal in European markets, but is not without importance, as it is sometimes employed as a substitute for good varieties or for adulterating them. An admixture of such bastard cardamom is betrayed by the inferior odor and taste. It is, however, not without value to compare the following figures of analysis.

Genuine shelled cardamoms contained:

Water	15·25 per cent.
Extract soluble in ether	5·10 "
Ashes, including dirt	6·55 "
Starch and sugar	28·84 "
Wood fiber, nitrogenous matter, extractive matter	44·26 "

Distilled with water, the volatile oil passed over, which has to be agitated with ether. According to Koenig it amounts to about 3·8 per cent; but Niederstadt has come across crushed cardamoms in commerce which contained only 0·28 per cent of essential oil.

Bastard cardamoms contained:

Water	15·50 per cent.
Extract soluble in ether	4·04 "
Ashes, including dirt	7·50 "
Starch and sugar (sugar 0·42 per cent)	24·00 "
Wood fiber, substances containing or free from nitrogen	48·96 "

Hence, outside of the smaller percentage of fat oil and essential oil, the two do not show any marked difference. The bastard cardamom, however, has a much more intense, camphorlike odor and taste, and leaves a sense of scratching and biting in the throat and on the tongue. Besides, the bastard cardamom is dirty gray, while genuine cardamom is yellowish-white. This lighter color, however, is not a natural one, but is produced by a bleaching process with sulphurous acid. This explains why sulphuric acid is frequently found present in the officinal cardamoms.

During the discussion Prof. Schaer also stated the great difficulty in examining cardamoms, as there exists no really reliable identity reagent, and called attention to the little value of microscopic investigation, when the seeds are in powder form. A useful estimation of genuine cardamoms may be founded, according to Schaer, on the fact that they always contain slight quantities of manganese. If manganese is easily detected in the ashes, the presence of genuine cardamom may be inferred.—Drogen und Farbw. Haendler (Drug and Dyestuff Dealer).

A Paris Automobile Test.

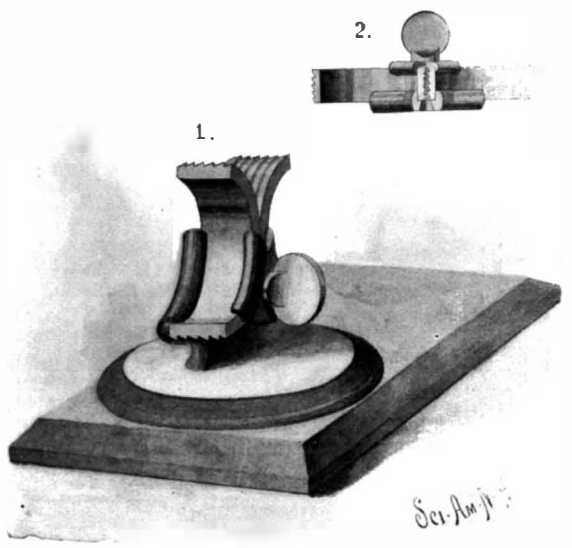
For some time there has been little or no news concerning automobile vehicles either in this country or abroad, but on February 14 there was a test between automobile vehicles which corresponds to the hill climbing contests of bicycles. This was the race up Suresnes Hill, at Paris, which corresponds very closely to the run from Fort Lee Ferry to the Hudson County Boulevard. The automobile vehicles were driven by M. René de Knyff and Baron de Zuylen, President of the Automobile Club de France. Though the recent rains played great havoc with the road, the contestants went up the long hill full tilt at the rate of fifteen miles an hour. Baron de Zuylen beat M. de Knyff by seventeen seconds.

A New Movement of the Heart.

A cablegram from Paris dated February 12 states M. Bouchard has discovered a new movement of the heart by means of the Roentgen rays. It is a rhythmic dilatation during respiration and is not connected with the ordinary movements of the heart. "It appears to arise," says The Sun, "from a diminution of pressure in the interior of the thoracic cage during inspiration."

AN IMPROVED KNIFE SHARPENER.

The illustration represents a simple and efficient device by means of which a knife may be quickly sharpened by simply drawing it between opposing sharpening jaws, the latter being so arranged that when one portion of the jaws becomes dull their position may be shifted to bring new sharpening faces in position to

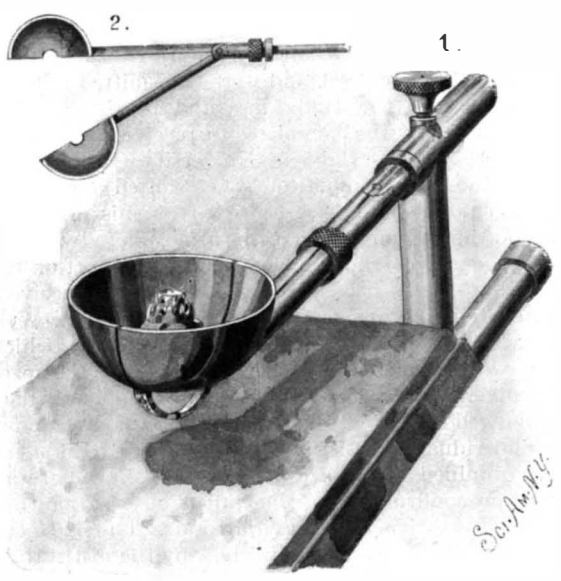


NIELSEN AND THOMSEN'S KNIFE SHARPENER.

engage the knife. The invention has been patented by Michael Nielsen and Thomas S. Thomsen, of No. 133 North Main Street, Port Chester, N. Y. Fig. 1 shows the device in perspective, Fig. 2 representing a top plan view showing the cutting edges of the teeth. To a suitable base plate is secured a head whose upper face has oppositely curved track surfaces, there being grooved flanges at one side of the tracks and an adjustable flanged cap plate, the head and cap plate being provided with opposing recesses at their upper central portions, and segmental jaws are held to slide upon the curved tracks between the flanged surfaces of the cap plate and head. The inner opposing surfaces of the jaws are toothed, the teeth being transversely inclined, and having straight shoulders facing the direction from which the knife is to be drawn. The construction is such that the parts may be separated quickly and as readily assembled, the adjustment of the sharpening edges or jaws being accomplished by means of the set screw, without detaching any of the parts.

A RING SET HOLDING CLAMP.

To hold rings and other articles of jewelry set with precious stones, so that the setting will not be affected by the heat while the operator is working upon them,



THOMAS' JEWELER'S CLAMP.

the special form of clamp shown in the illustration has been invented and patented by Fred J. Thomas, of No. 225 Eighth Street, Cairo, Ill. Fig. 1 shows the device in position for work, Fig. 2 being a separate view of the clamp proper. On a suitable support, which also carries the charcoal pan, is a head and horizontally projecting stem, on which are pivoted two arms, adapted to swing to the open position shown in Fig. 2 or to the closed position to engage a ring or other article, as indicated in Fig. 1, the arms being held in closed position by a sliding collar, which is also adapted to slide over the head. On the free end of each arm is a quadrispherical bowl section, the sections registering where the arms are closed to form a hemispherical bowl, in the bottom of which are registering openings designed to receive the body of the article of jewelry as it is held by the clamp over the charcoal pan. These openings may be of any desired form to receive and hold different articles of jewelry in such manner that the bowl will protect the settings from the heat while the work is being carried on.

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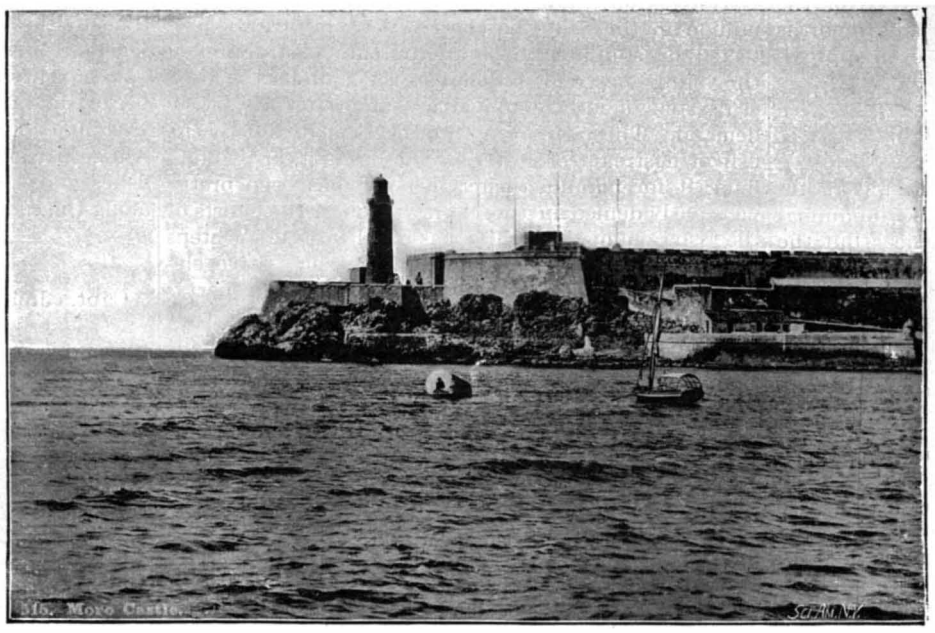
THE LOSS OF THE BATTLESHIP "MAINE."

It would be scarcely possible to find in all the records of naval disaster, certainly not in those of the United States, a calamity so shocking and overwhelming as the loss of the battleship "Maine." It was misfortune enough that our navy, none too strong for its many duties, should be deprived at a stroke of one of its most efficient ships; but when to this is added the fact that the explosion which rent the ill-fated vessel asunder swept some 250 of our brave sailors into eternity, the disaster is comparable only with the sinking of the "Victoria," when 359 officers and men were lost, or that awful tragedy of an earlier day, when "brave Kempenfelt went down with twice four hundred men."

By the time these lines are in the hands of our readers they will be familiar with the details of the disaster, and it is likely that some reasonable theory based upon the condition of the wreck will have been offered as to the direct cause of the explosion. At the present writing public opinion is divided as to whether the explosion was due to accident or malicious design. If it was accidental, the cause must be looked for within the ship itself; but if the explosion was due to a deliberate act of malice or treachery, it is likely that the mischief was wrought by a torpedo or a sunken mine directed against the submerged portion of the hull.

The "Maine" has generally been known as a second-class battleship, though, more strictly speaking, she belongs to the class of armored cruisers. She was built at the Brooklyn Navy Yard, launched in the year 1890 and formed one of the most efficient ships of the new navy. Her principal dimensions were as follows: Length, 318 feet; beam, 57 feet; draught, 22½ feet; displacement, 6,682 tons; coal supply, 400 tons; bunker capacity, 896 tons. She was driven by twin engines of 9,293 horse power at a speed of 17·4 knots and carried a complement of 354 officers and men. For her size she was heavily armed, carrying four 10-inch guns in two turrets, plated with 10 to 12-inch armor, six 6-inch guns, eight 6-pounder guns, eight 1-pounders and four machine guns. She carried two torpedo boats on her boat deck and was provided with no less than seven torpedo discharge tubes. Her belt armor was 12 inches thick and she had a continuous protective deck, from 2 to 4 inches thick, extending from stem to stern. Altogether, the "Maine," with her combination of good protection, heavy gun fire and torpedo fire and high speed, was one of the most useful ships in the navy.



MORO CASTLE AT THE ENTRANCE TO HAVANA HARBOR.

The presence of the "Maine" in Havana Harbor was in strict accordance with international courtesy. She represented this country at the chief port of Cuba. Her mission was friendly. At the same time it was well understood by both governments that the immediate cause of her being stationed at Havana was the recent occurrence of riots in the city and the desire of this government to be in a position to safeguard the rights and property of its own citizens in case of any violent demonstrations. Our ship was anchored in the middle of the harbor abreast of the city wharves, and at no great distance were the Ward Line steamer "City of Washington" and the Spanish warship "Alphonso XII."

The city of Havana is located on the shores of a capacious landlocked harbor whose contracted entrance is guarded by the at once famous and infamous Moro Castle on one side and by the Punta Castle on the other. The former has figured largely in the present war, and the accompanying illustrations of Havana and its noted fortress will have a special interest at the present juncture. The historic cathedral shown in another engraving is already well known to Americans for its association with the name of Columbus. It will henceforth take on an added and painful interest as having witnessed the funeral services of our sailors and marines who have died in the service of their country by an untimely but none the less meritorious death.

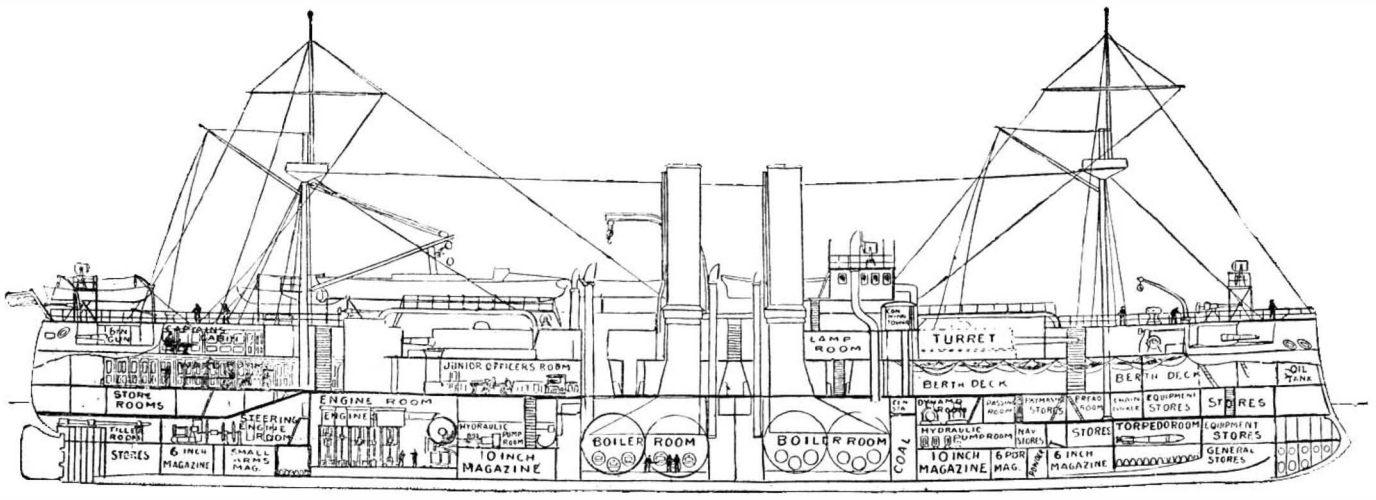
On the evening of Tuesday, February 15, after the usual inspection of the ship had been made, and the crew had swung into their hammocks for the night, suddenly, and without the least preliminary warning, the "Maine" was torn open by an explosion which sent her to the bottom and killed, according to present reports, 253 out of her complement of 354 officers and men. The fatalities were confined almost entirely to the crew, only two of the officers being included in the list of dead or missing; and this is accounted for by the fact that the explosion occurred in the forward half of the ship, where most of the men were berthed—the officers' quarters being at the after end of the ship. Lieut. Blandin gives a graphic account of the disaster, from which we quote:

"Scarcely had I spoken when there came a dull, sullen roar. Would to God that I could blot out the sound and the scenes that followed! Then came a sharp explosion; some say numerous detonations. I remember only one. It seemed to me that the sound came from the port side forward. Then came a perfect rain of missiles of all descriptions, from huge pieces of cement to blocks of wood, steel railings, fragments of gratings, and all the debris that would be detachable in an explosion.

"I was struck on the head by a piece of cement and knocked down; but I was not hurt, and got to my feet in a moment. Lieut. Hood had run to the poop; and I supposed, as I followed, he was dazed by the shock and about to jump overboard. I hailed him, and he answered that he had run to the poop to help lower the boats.

"When I got there, though scarcely a minute could have elapsed, I had to wade in water to my knees, and almost instantly the quarter deck was awash. On the poop I found Capt. Sigsbee as cool as if at a ball, and soon all the officers, except Jenkins and Merritt, joined us. The poop was above water after the "Maine" settled to the bottom. Capt. Sigsbee ordered the launch and gig lowered, and the officers and men, who by this time had assembled, got the boats out and rescued a number in the water. Capt. Sigsbee ordered Lieut.-Commander Wainwright forward to see the extent of the damage, and if anything could be done to rescue those forward or to extinguish the flames, which followed close upon the explosion and burned fiercely as long as there were any combustibles above water to feed them.

"Lieut.-Commander Wainwright, on his return, reported the total and awful character of the calamity, and Capt. Sigsbee gave the last sad order, 'Abandon ship!' to men overwhelmed with grief, indeed, but calm and apparently unexcited."



LONGITUDINAL SECTION THROUGH BATTLESHIP "MAINE."

We publish an exterior view and a longitudinal section of the "Maine," which fully explains the frightful fatality among the crew. The terrific force of the explosion renders it almost certain that it was the forward magazines which exploded. There were two of these—the forward one, containing the ammunition for the 6-inch guns, being situated about 50 feet from the bow, that containing the 10-inch gun ammunition being situated further aft, at about 90 feet from the bow; between them was stored black powder and smaller ammunition. The combined weight of the explosives in these compartments was no less than thirty tons! By reference to the engravings it will be seen that, slung in their hammocks above this sleeping volcano, on what is known as the berth deck, were the crew, and it is a mournful consolation to realize that the killed probably knew nothing of the pangs of death—so terrific must have been the blast.

HAVANA CATHEDRAL.

According to the testimony of a passenger upon the "City of Washington," there were two distinct explosions, the interval between them being sufficient to give him time to run up on deck and witness the falling debris of the wreck. The ship took fire at once, and was so badly shattered and went down so swiftly that some of the survivors had barely time to climb through the hatchways and escape being drowned between decks. Boats were immediately lowered from the "City of Washington" and from the Spanish cruiser, and these succeeded in picking up a large number of the survivors. A dramatic incident occurred when an officer of the "Maine," in one of the rescuing boats, called out: "If there is any one living on board, for God's sake say so!" The only answer was an echo from the distant shore, which repeated "for God's sake."

The disaster has produced a profound sensation throughout the world, and expressions of deep sympathy have appeared in the press and have poured in upon our government from all the governments of the civilized world. The dignified self-restraint of the American people in the presence of such a trying climax has won universal approval, and it is being realized that for the present at least we must follow the suggestion

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contained in the famous telegram of Captain Sigsbee, of the ill-fated ship, and "suspend judgment."

A board of inquiry, consisting of Captain Sampson, Captain Chadwick, Lieutenant-Commander Schroeder and Lieutenant-Commander Marix has been appointed, and will conduct an exhaustive examination of the survivors and of the wreck itself. Until its report is made it will be impossible to determine, even approximately, the cause of the disaster.

Breeding Fish by the Million.

BY GEORGE ETHELBERT WALSH.

The grand fiasco of the sealing question is an unpleasant reminder of the uncertainty of all wild animal life on the globe unless protected by science; but the apparently abortive efforts to save the seals by international agreement are partly offset by a general movement to establish an International Fishery Association. The United States government has issued invitations to the governments of all the European countries and to those of China, Japan, Mexico, Brazil and Venezuela to confer with the United States Fish Commission for the purpose of co-operating in protecting and propagating the fishes of the seas, gulfs and oceans.

It is with commendable pride that the United States Fish Commission takes the initial step in the direction of elevating all questions affecting the food supplies of the ocean from the arena of politics and international disputes into the realm of science. That such questions should never have been a matter of politics no one with a knowledge of the subject disputes. If further proof were needed, however, it would only be necessary to glance over the work of the United States Fish Commission, and of the various State commissions, to see what can be accomplished in this direction in the name of science, when not handicapped by political "pulls" and "deals." The work of increasing the food supply of the seas, rivers and lakes of the country is pursued so quietly, and with so little ostentatious display, that very few realize its importance or the far-reaching results.

In the earliest times the food fish of the water formed a valuable source of sustenance for a large percentage of the population, and an increasing industry was built up as new methods for harvesting and preparing the fish were devised. The simple savages contented themselves with spearing and snaring the finny members of the rivers, lakes and seas; but, as population increased, and the cunning of man in overcoming his environments developed, the fish hook and the seine were brought into more perfect use. The consumption of fish increased with the advent of new methods for catching and preserving them. Early in the present century many of our most important species of food fishes were threatened with extinction. Like our song birds and game birds, laws had to be enacted to limit the destruction; but these were considered inadequate in view of the just demand that a large class of fishermen, who depended upon the fisheries for a living, had to be supported by catching the products of the water without undue molestation.

The problem threatened to become a serious one in this country, where thousands of fishermen made their living in this industry, and either they would have to be restricted in the exercise of their past privileges so that their earnings would be cut down one-half, or they would have to be left alone until they destroyed all of the fish of the sea and were left without any visible means of making a livelihood. In either case considerable suffering would have resulted. Fortunately for all concerned, science came to the rescue about this time, before it was too late, and under its guidance our fisheries, instead of deteriorating, have suddenly expanded and developed into one of the most important industries of the North American continent.

We are not entirely out of the woods yet, as some of our food fishes are almost on the verge of complete extinction; but the promises of artificial propagation are so satisfactory and flattering that one feels sure that the end is not yet. At first it was thought that all a fish commission could do was to restock lakes and rivers with young fry, and to remove the worst enemies from the vicinity; but this to-day would be considered a very small and unimportant part of the duties of the national or State commission. The chief work that is performed by the State hatcheries is the propagation of millions of fish under conditions that make the percentage of deaths small and insignificant. It is well known now that of the millions of eggs of food fishes deposited in the sea, rivers and lakes, the greater part are eaten or otherwise destroyed. Consequently, the multiplication of the most valuable food fishes by natural methods does not begin to keep pace with the demand for them.

But in the State hatcheries the percentage of fertile eggs that are hatched out is large, and nearly all of the young fry escape the ordinary dangers that prevail in their natural habitat. There are no voracious creatures to pursue and devour them when first released from their shells, and they grow and thrive under conditions peculiarly adapted to their requirements. Almost all kinds of food fishes are now increased by artificial propagation, and those that cannot be hatched artificially are protected and indirectly benefited by wise laws. Special investigations are being made to-day of certain species of fishes which are threatened with extinction, and methods will be adopted to check their diminution in numbers.

Oysters, for instance, cannot be hatched out by the million in the State hatcheries; but they can be protected by stopping the indiscriminate destruction of the young ones, and this enables them, under the modern system of culture, to increase almost as fast as the demand. The right of a single person to destroy the fish of a stream of water by poisoning it, or by damming it for manufacturing purposes, has been pretty vigorously denied in the courts through the efforts of the Fish Commission, which has in all cases taken steps to stop such a nuisance. The fish in their native element are considered public and not private property, and it is in the interest of the community at large that they are protected and their numbers increased. This principle of the United States Fish Commission is now generally recognized as a just and sound one; but when it was first announced, vigorous opposition was met on all sides by selfish or ignorant people.

The protection of the lobsters on the New England coast was bitterly opposed by the old fishermen, who thought it an infringement upon their personal rights to stop them from catching these crustaceans at any season of the year they pleased, as they had been in the habit of doing in the past. The laws, in many cases, had to be enforced at the point of the shot gun, as the oyster navy of Maryland is compelled to do at times even to-day. But time has had an opportunity to change the lobstermen's hatred into surprised gratefulness. The lobster hatcheries at Gloucester and Wood's Holl have turned loose thousands of young crustaceans annually for several years now, and these have gladdened the hearts of the fishermen. The industry is improving so rapidly under the protection of the State laws, and the annual restocking of the waters, that as much money can now be made in the lobster season as one formerly could make in the whole twelve months. Moreover, the fishermen now of their own accord throw back into the water all lobsters under eight or ten inches long. One female lobster will yield from ten thousand to seventy-five thousand eggs in one season; but probably not more than half of one per cent of these will ever hatch and reach maturity in the water. Other lobsters, parasites, disease and fish-eating inhabitants of all kinds destroy these eggs and the young lobsters by the thousand, and their multiplication is very slow. But in the fish hatcheries the eggs are protected from all enemies, and the young lobsters are not turned loose until they have attained a size which enables them to care for themselves.

The Fish Commission has been so successful in restoring the lobster industry to its former normal condition that efforts are now being directed toward the poor terrapins—a delicious luxury that is rapidly disappearing. Unless the terrapin industry can be protected by law, and the creatures multiplied by artificial propagation, we will soon have to strike one of our favorite dishes from our future menus. At present it is difficult to get any but very small terrapins, so closely and vigorously are they killed off every season.

When we come to consider the success of shad, salmon and trout propagation, we begin to realize more definitely the value of the national and State fish commissions. Our rivers have been restocked with shad and salmon until they seem to be literally choked with them in the running season. During the past year ninety-three million young shad fry were turned loose into the rivers flowing into the Atlantic Ocean and Gulf of Mexico. Efforts are now being made to introduce the Pacific coast salmon in our Eastern waters, and some five million eggs have been sent to stations in New York and the New England States. The young fry will be liberated in the Hudson, Susquehanna, Merrimac, Kennebec and Penobscot Rivers. If they prove successful in their new homes, our streams of water will greatly increase the food supply of the country, and both consumers and fishermen will be benefited by the process. An important branch of the work carried on by the Fish Commission is exchanging fish fry in different parts of the country, and the State commissions are prosecuting this work energetically also. A more even distribution of the food fish will thus be accomplished at little expense. Before the shad hatcheries were established on the Hudson and Connecticut, this valuable fish was beginning to grow exceedingly scarce in all the Atlantic coast rivers; but there is an abundance of the fish each spring now.

All of the old trout streams and lakes have been made valuable again by the artificial propagation of this gamy fish. Originally many of our streams and ponds were full of trout, and the early fishermen would often take a thousand pounds a year from one small stream; but the steady destruction of them depleted their numbers so that few could be found when needed. Then came the establishment of the trout hatchery on the Caledonia Creek in New York State, under the control of the State fish commission, and with Seth Green, the pioneer in the industry, as superintendent. From this small experimental station the work grew, until it is worth many thousands of dollars to the people of the State to-day.

The State commissions co-operate with the national Fish Commission; but their particular fields of operation are so well defined that they do not conflict. The United States Fish Commission devotes most of its time to the restocking of streams that pass through several States, and to the multiplication of the principal sea fishes. Besides liberating the enormous number of shad fry last year, the commission turned loose 98,000,000 young lobsters and about 24,000,000 mackerel. Altogether it hatched 885,000,000 eggs of valuable food fishes and turned the young fry loose in the waters along the coasts of our country.

Science Notes.

Capt. James Brown, commander of the "Windward," lately presented to Lieut. Peary by Mr. Harmsworth, has spent thirty-nine years and made thirty voyages in Arctic waters. His father and grandfather were engaged in Arctic work before him.

At a meeting of the American Geographical Society at Chickering Hall, February 14, Alfred G. Harmsworth, of London, who lent his ship "Windward" to Explorer Peary was elected an honorary member. Cosmos Mindeleff, of the Ethnological Bureau of the Smithsonian Institution at Washington, delivered a lecture on the origin of the cliff dwellings in the Southwest.

"La Fronde," a daily political and literary journal, edited, managed, set up and printed by women, has made its appearance in Paris, price one sou. Mme. Marie Durand, late of the Théâtre Français, is the founder; Mmes. Sévérine and Pognon write the editorials, Mme. Dieulafoy archæological articles, and Mlle. Chauvin, doctor of laws, whose application for admission to the bar was recently rejected, covers the law courts. Of the first edition 225,000 copies were printed.

Investigations have recently been made as to the number of cabinet officers who were college graduates. Out of 262, 178 or more than two-thirds have been college graduates. Of this number, Princeton had 22 representatives; Yale and Harvard, 21 each; William and Mary, 10; Dickinson, 9; University of North Carolina, 8; Dartmouth, 7; West Point, Drew and the University of Pennsylvania, 5 each; Universities of Virginia and Brown, 4 each. Three other institutions have 3 each; eight are represented by 2 each, and three by 1 each.

The Edward P. Allis Company has received from Seth Low, President of Columbia University, New York, his acceptance of an offer by the company to equip a steam laboratory in the Department of Engineering in the university. The laboratory is to be known for all time as the Edward P. Allis Memorial. The gift of the Allis company consists of a model triple-expansion Corliss engine, as perfect a piece of machinery as it is possible to turn out, and an air compressor. The two are worth $150,000. The engine will be run at the university merely to illustrate its mechanism for the benefit of the students.

To France belongs the merit of having laid the foundations of the systematic study of ancient volcanoes, says Sir Archibald Geikie. As far back as the year 1752, Guettard recognized that the Puys of Auvergne were volcanic cones that had poured forth streams of lava. But it was reserved for Desmarest twelve years later to examine the question in detail, and to establish the investigation of former volcanic action upon a broad and firm basis of careful observation and sagacious inference. He discovered that the volcanoes of central France were not all of one age, but had made their appearance in a long series, whereof the individual members became less perfect and distinct in proportion to their antiquity. While these fruitful researches were in progress in France, others of hardly less moment were advancing in Scotland. Hutton, as a part of his immortal "Theory of the Earth," had conceived the idea that much molten material had been injected from below into the terrestrial crust, and he had found many proofs of such intrusion among the rocks of his native country. His observations, confirmed and extended by Playfair and Hall, and subsequently by Macculloch, opened up the investigation of the subterranean phases of ancient volcanic action.

The Current Supplement.

The current number of the SUPPLEMENT, No. 1156, contains a number of articles of interest. Technology is represented by articles on "The Artificial Silk Industry" and "Gutta Percha—Its Properties and Uses." "An Improved Sunshine Recorder" and "The Magnetic Properties and Electrical Resistance of Iron at a High Temperature" are important articles in meteorology and electricity. Natural history is represented by an article on "Hibernation" and a paper by Dr. George Archie Stockwell on "A Humbug—Art versus Nature," describing some of the curious composite sea monsters for which we are indebted to Japanese artists who prepare "mermaids" for the market.

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INSECT GRAFTING.

BY WILLIAM H. HALE, PH.D.

Mr. Henry E. Crampton, Jr., an instructor at Columbia University, has for a year or more been conducting experiments in grafting together different insects so as to make composite forms. Very little publicity was given to the matter, however, till Prof. John B. Smith, the well-known entomologist of New Jersey, called attention to it a few days ago, and indicated that it was likely to produce valuable as well as curious results.

His experiments have been almost all performed on the Bombycid moths, particularly Philosamia cynthia, Samia cecronia, Callosamia promethea and Teles prometheus. These all have large chrysalids, and hence can be more readily manipulated, for the grafting is done in this stage of development.

Fig. 1.—TANDEM UNION, SAME SPECIES.

The process consists of cutting two chrysalids, putting the cut edges together, and fastening them by brushing the line of union with melted paraffine, which at once hardens and holds the pieces firmly together. When the moth is sufficiently developed to leave the chrysalis, the operator assists by picking off the shell in bits. This is generally necessary because of the abnormal condition of the insect under this treatment. About ten per cent of the insects operated on have lived to reach the imago stage, the proportion being larger when the two individuals selected were of the same species, and much smaller, about six per cent, when they were of different species; the first being called homoplastic, the second heteroplastic union. An attempt will be made this season to breed from some of the moths produced by grafting.

Mr. Crampton was the first to apply grafting to

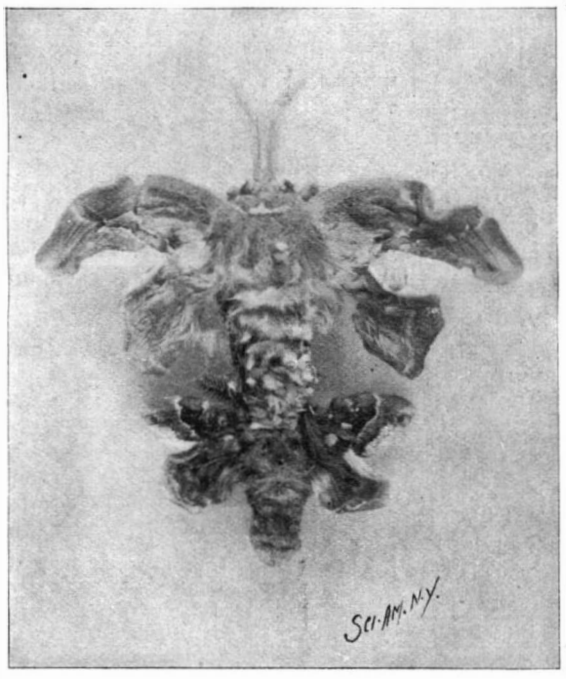

Fig. 2.—TANDEM UNION OF MOTHS OF DIFFERENT SPECIES.

insects. Prof. Born, in Germany, had already grafted toads and frogs in the tadpole state; other experimenters had grafted hydræ and also earth worms.

The primary object of the experiments on insects was to ascertain the effect of grafting on the color of

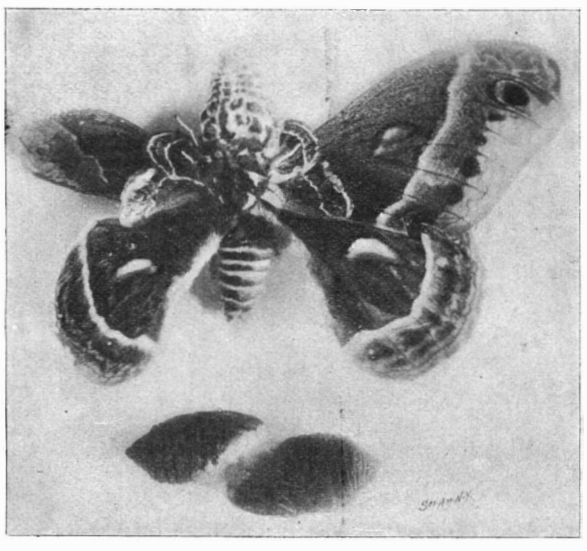

Fig. 3.—TWIN UNION OF MOTHS HEAD TO HEAD.

insects. In many species of insects the male and female present marked difference in coloration. An instance is the Collosamia promethea, a specimen of which I saw in Mr. Crampton's laboratory, part of a male and part of a female moth being united together. The results as to coloration, however, are not yet considered satisfactory.

Inasmuch as color is due to the chemical constituents of the food as affected by the digestive or other chemical change produced in the body of the insect, the study is of much scientific interest. It may also have a very practical application if we can artificially impart a protective coloring to useful insects.

It is found that the proportion of successful operations is better when more than half of each pupa is used. The process of grafting involves some loss of hæmatolymph; and this loss can only be made up by increasing the amount of pupa retained.

It proved that all attempts to join lateral halves of two different pupæ in normal proportions—half of each—were unsuccessful.

The tandem unions succeeded a little better where only normal proportions were used. Fig. 1 shows such a union of two individuals of the same species. Where the species were different, however, only one successful attempt was made out of thirty-two. In this case the anterior portion is Cynthia, the posterior Promethea.

Tandem unions taking more than half of each pupa succeeded much better. About twelve per cent survived. These unions gave monstrosities with elongated bodies and two sets of wings, as shown in Fig. 2, where again the anterior portion is Cynthia and the posterior Promethea.

The twin unions were by far the most successful, as but little of the pupa was cut off. Fourteen out of sixty-nine survived. These were made in great variety: head to head; tail to tail; back to back; and in some cases fusion of wings was produced by exposing the roots of pupal wing cases and uniting the wounds. Figs. 3, 4, 5 and 6 show various unions. I also noticed at the laboratory one specimen in which the antennæ were united at the base.

It sometimes happens when pupæ of different species are united that one will mature before the other. Mr. Crampton now has such a specimen which was united "tandem." The tail part has matured and come out alive; the head still lives in the chrysalis state, but will probably come out alive before this is printed.

Mr. Crampton explained to me that the work of insect grafting was taken up by him rather as an amusement and recreation from more arduous labors. He has just discovered by further experiments on fused moths an example of a reciprocal color effect, believing that the color of one kind of moth will appear in a portion of another kind. No doubt other important discoveries will be made as further experiments are continued. What has been accomplished is quite novel and interesting.

The 1897 Fire Loss.

The fire loss of the United States and Canada for the year 1897, as compiled by The New York Journal of Commerce, shows a total of $110,319,650. The following comparative table shows the losses by months for the years 1895, 1896 and 1897:

	1895.	1896.	1897.
January	$11,895,600	$11,040,000	$12,049,700
February	12,360,200	9,780,100	8,676,750
March	14,239,300	14,839,600	10,562,950
April	11,618,150	12,010,600	10,883,000
May	7,761,350	10,618,000	10,193,600
June	9,223,000	5,721,250	5,684,450
July	9,085,000	9,033,250	6,626,350
August	9,929,000	8,895,250	6,454,000
September	10,766,300	8,200,650	9,392,000
October	13,411,500	8,993,000	11,387,500
November	10,131,500	5,211,800	7,189,800
December	10,018,800	11,962,000	11,328,650
Totals	$129,839,700	$115,655,500	$110,319,650

English Spoken and Written.

At the recent Postal Congress attention was called to the fact that two-thirds of all the letters which pass through the post offices of the world are written by and sent to people who speak English. There are substantially 500,000,000 persons speaking colloquially one or another of the ten or twelve chief modern languages, and of these about 25 per cent, or 125,000,000 persons, speak English. About 90,000,000 speak Russian, 75,000,000 German, 55,000,000 French, 45,000,000 Spanish, 35,000,000 Italian, and 12,000,000 Portuguese, and the balance Hungarian, Dutch, Polish, Flemish, Bohemian, Gaelic, Roumanian, Swedish, Finnish, Danish and Norwegian. Thus, while only one-quarter of those who employ the facilities of the postal departments of civilized governments speak as their native tongue English, two-thirds of those who correspond do so in the English language. This situation arises from the fact that so large a share of the commercial business of the world is done in English, even among those who do not speak English as their native language. There are, for instance, more than 20,000 post offices in India, the business of which in letters and papers aggregates more than 300,000,000 parcels a year, and the business of these offices is done chiefly in English, though of India's total population, which is nearly 300,000,000, fewer than 300,000 persons either speak or understand English.

Though 90,000,000 speak or understand Russian, the business of the Russian post department is relatively small, the number of letters sent throughout the Czar's empire amounting to less than one-tenth the number mailed in Great Britain alone, though the population of Great Britain is considerably less than one-half of the population of Russia in Europe. The

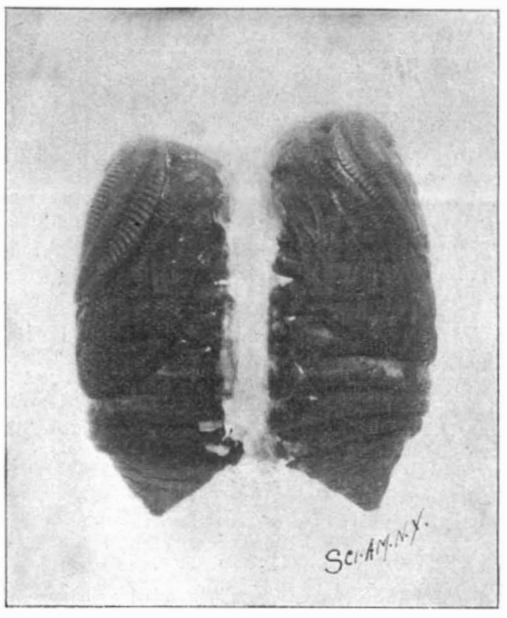

Fig. 4.—TWIN CHRYSALIS, UNITED.

Southern and Central American countries in which either Spanish or Portuguese is spoken do comparatively little post office business, the total number of letters mailed and collected in a year in all the countries of South and Central America and the West

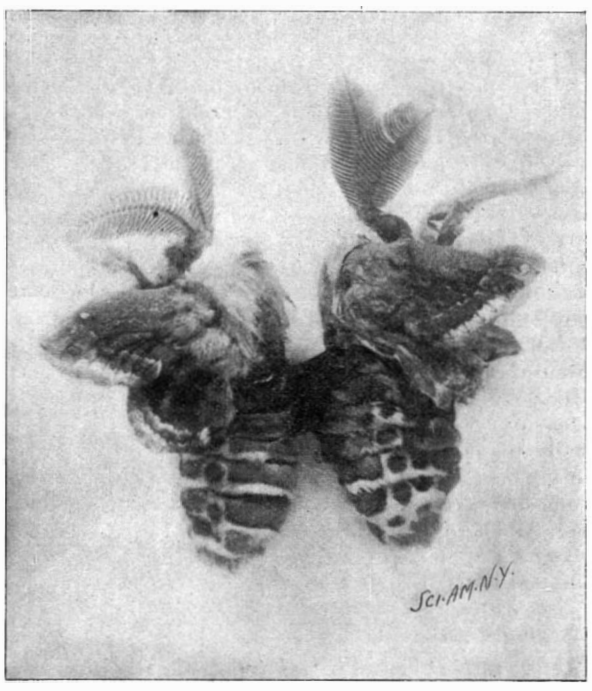

Fig. 5.—TWIN CHRYSALIS OF Fig. 4 IN PROCESS OF DEVELOPMENT.

Indies being less than in Australia. Chile and Argentina are, in fact, the only two South American countries in which any important postal business is done, and most of the letters received from or sent to foreign countries are not in Spanish, but in English, French, German or Italian.

NEW YORK'S zoological garden will be the largest in

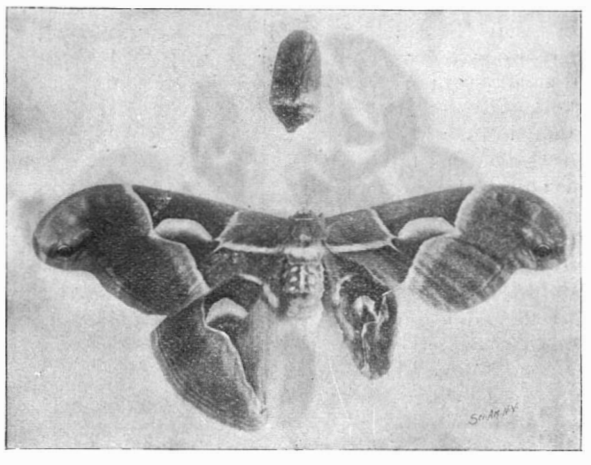

Fig. 6.—HOMOPLASTIC UNION, SHOWING UNEVEN SIZE OF WINGS.

the world, comprising within its boundaries no less than 261 acres. The next largest is at Washington, which has 168 acres. The Berlin garden has 60, the Paris garden 50, and the London garden 31 acres.

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THE NEW EXPERIMENTAL LOCOMOTIVE FOR PURDUE UNIVERSITY.

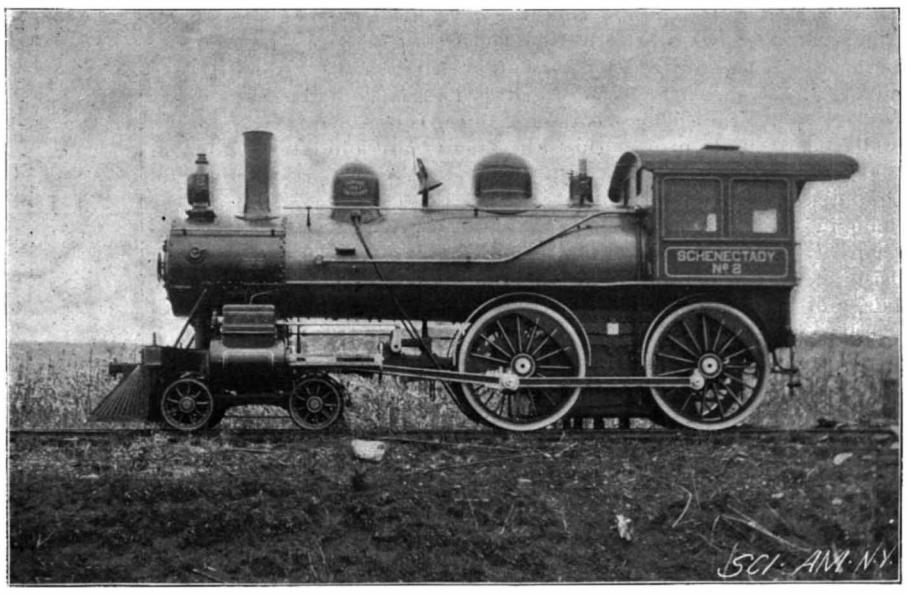
The engineering world has benefited greatly from the laboratory tests which have been carried out from time to time upon the Schenectady locomotive which was built some years ago and shipped to the university for laboratory work. The advance which has taken place of late years in locomotive designs has rendered this machine somewhat out of date, and it is now to be replaced by a new locomotive of which we present an illustration. The engine is of the American eight-wheel type, and at first glance it would not appear to differ from the common type. As a matter of fact, however, it possesses many special features determined by the Purdue authorities, and various interesting details inserted by the builders.

The cylinders are bored out to 20 inches diameter and are provided with bushings 2 inches in thickness, so that their present dimensions are 16 inches diameter by 24 inches stroke. The bushings will be bored out to give various dimensions, and the saddle has been so constructed as to permit of a 30-inch low pressure cylinder being added for the purpose of testing the locomotive as a compound. Allan Richardson valves are used. They have a maximum travel of 6 inches with a 1¼-inch outside lap. Steam ports measure 18 inches by 1⅝ inches and the exhaust port 18 inches by 3 inches. The boiler carries a working pressure of 250 pounds to the square inch. The firebox is 6 feet long and 34¼ inches wide, the grate area being 17¾ square feet. The drivers are 5 feet 9¼ inches in diameter and they carry a weight of 61,000 pounds, the total weight of the engine being 96,000 pounds.

The crank pins and crosshead pins, the piston rods and main axles, are all made of fluid compressed acid open hearth nickel steel annealed, and all except the piston rods are hollow and oil tempered. The great mortality of these parts in locomotives has led engineers to seek for some metal of high elastic limit and elongation which would successfully resist the severe alternating stresses to which they are subjected. When steel was first substituted for wrought iron in locomotive crank pins, a soft, low carbon steel was generally employed, and failures due to "fatigue of metal" were almost as frequent as before. The broken pins showed what has been called "a fracture in detail"—a gradual parting of the steel extending inward all around the piece, undoubtedly produced by the working strains repeatedly approaching the low elastic limit of the soft steel. On substituting a higher carbon steel with an elastic limit of 45,000 to 50,000 pounds per square inch, failures were greatly diminished without changing the diameter or shape of the pins. Steel of still higher elastic limit and proportionately greater elongation gives correspondingly better results, and many of the representative railroads of the country are considering the adoption of and others have already adopted nickel steel wherever it can be used on their locomotives; and where the form and size of the forgings will allow of such treatment, they are made hollow in order that they may be oil tempered to still further increase the physical properties of the metal. Test bars from the forgings for the locomotive show the following results in test specimens ½ inch diameter and 2 inches long between measuring points:

Tensile strength	91,000 pounds.
Elastic limit	57,000 "
Elongation	25·05 per cent.
Contraction	56·45 "

We are indebted for the above particulars to Prof. W. F. M. Goss, the director of the engineering laboratory at Purdue University.



LOCOMOTIVE FOR THE PURDUE UNIVERSITY LABORATORY.

Cylinders, 16 to 20 inches by 24 inches; drivers, 5 feet 9 inches; steam pressure, 250 pounds; weight, 96,000 pounds.

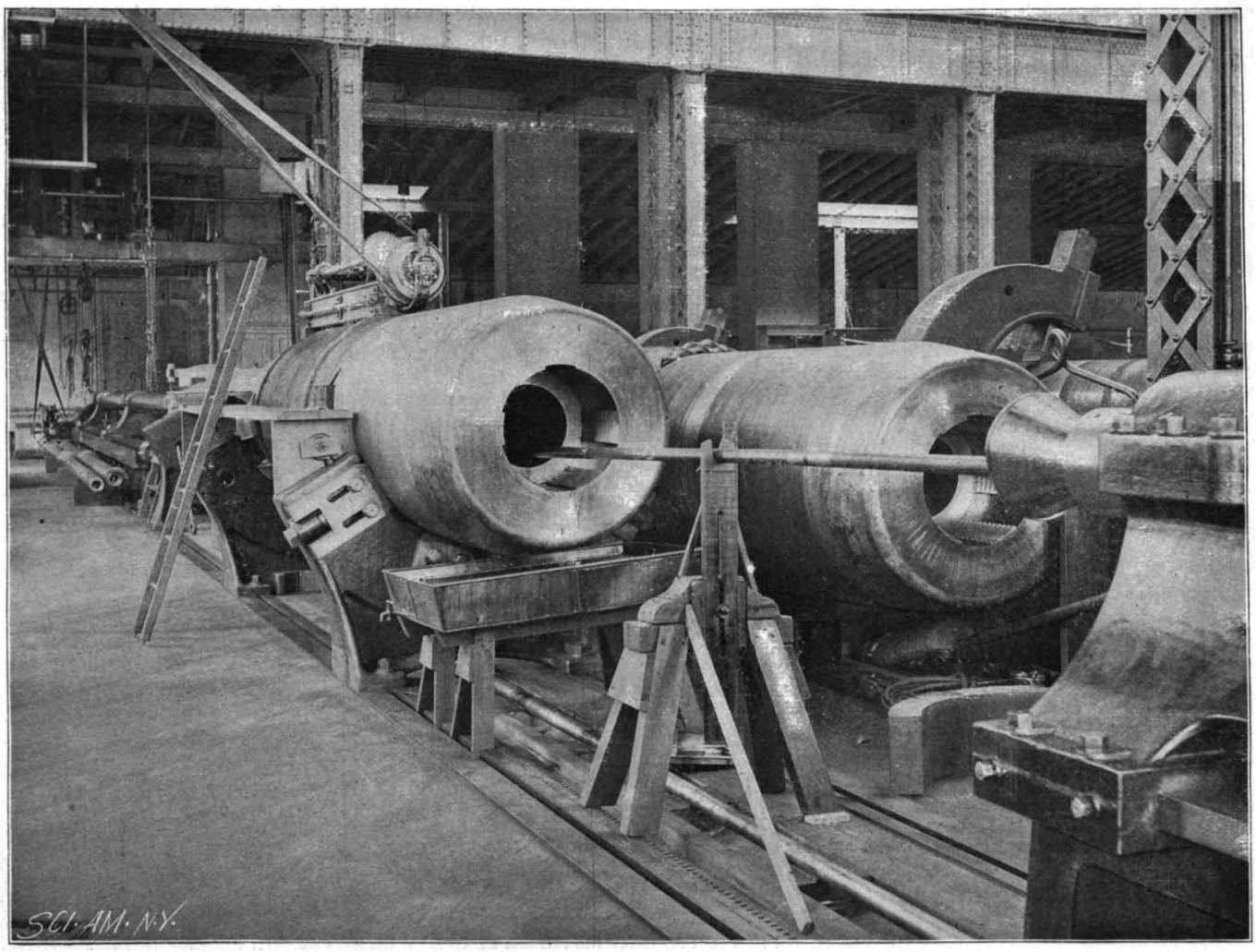
THE GUN FACTORY AT THE UNITED STATES WASHINGTON, D. C, NAVY YARD.

The modern cannon is a work of the highest mechanical order. In former days the gun founder often cast very beautiful cannon of artistically elaborate design. To-day the gun leaves the assembling shops a rigorously plain structure, yet in degree of accuracy of workmanship exceeding almost any class of mechanical work. Our illustrations give views from the Washington navy yard, where in the course of years a gun assembling plant has been organized which now represents about $2,000,000 investment. In its mechanical excellence it is believed to be the equal of or to exceed any similar shop. The operations performed in the navy yard are the machining and assembling of the different pieces received as forgings from the steel works. The parts composing the barrel or body of the piece are turned and bored. They are then put together with shrinkage. The breech mechanism is constructed and put together and the gun is ready for mounting and for trial at the proving grounds. The size of main battery guns is specified by stating the diameter of the bore. At the navy yard the calibers of such guns thus far manufactured are 4-inch, 5-inch, 6-inch, 8-inch, 10-inch, 12-inch, and 13-inch. The capacity of the largest lathe provides for a gun of 16-inch bore, though so large a piece is never made there now.

The gun is built up of three parts—tube, jacket and hoops. Taking the 4-inch gun as the simplest in construction, it consists first of the tube. This is a tubular piece of steel bored out to the 4-inch caliber and rifled, forming the barrel of the piece. It extends from the muzzle of the gun to the rear of the powder chamber. The gun is prolonged a few inches more to the rear, by the extension of the next piece, termed the jacket. The tube is turned in the main to an exterior cylindrical contour with some variations in diameter producing shoulders to give a lock or grip for the jacket or hoops.

Over the rear portion of the tube is shrunk on the jacket. This is another approximately cylindrical piece, which covers between one-third and one-half of the length of the tube. Thus in the gun described the tube is 160 inches long and the jacket is 74 inches long. The gun is further strengthened by additional pieces, termed hoops, also shrunk on. In the 4-inch gun a hoop 38 inches long is shrunk over the tube immediately forward of the jacket. A very short hoop 12 inches long is shrunk over the forward end of the jacket and rear end of the 38-inch hoop. These complete the parts of the gun. Hoops which are forward in position are termed chase hoops. The larger guns are more complicated. In some cases the chase hoops extend to the muzzle, and the jacket is strengthened by jacket hoops, so that the gun is in part built up of three layers. Thus one type of 13-inch gun has four jacket hoops, each directly forward of its neighbor, and forward of these come four principal chase hoops, besides two small finishing hoops, giving twelve pieces for the barrel.

The gun forgings are made from open hearth steel cast originally in ingots, each weighing about twice as much as the finished piece is to weigh. The ingot is forged down, rough bored and turned nearly to the finished dimensions, and test specimens are taken from one or both ends after the forging has been annealed, oil tempered and again annealed. If satisfactory, it is accepted by the government.



POLISHING THE BORE OF A LARGE GUN AND CUTTING A KEYWAY ON THE EXTERIOR FOR A BRASS SLEEVE.

The gun shop work is principally turning and boring, there being nine principal lathes. The work has to be done with the utmost accuracy; for shrinkage, it is done to $\frac{1}{1000}$ inch. As standard, the workman receives a point gage. This is a simple rod of steel, with polished ends, whose length is precisely the diameter of the work. Its length, which is as accurate as can be determined by a dividing engine. is marked on it The workman sets his calipers by this gage.

The great masses of metal are clamped to the face plates of the lathes and have their weight carried in steady rests. Seats are turned often in the piece for the steady rests. The lathes are gigantic structures. The largest can take in a gun 48 feet 7 inches long and weighing 110 tons. It is about 115 feet long and cost nearly $100,000. It is now used for boring the

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FINISHED GUN PROVIDED WITH TEMPORARY SHOP.

GENERAL VIEW OF INTERIOR OF GUN FACTORY AT WASHINGTON.

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tubes. The general course of operations is as follows: The jacket is bored to the required diameter and is stargaged. This involves an interior calibration at several hundred points. The tube is bored out nearly to finished size, and its breech end is turned exteriorly to a size as much in excess of the inner diameter of the jacket as the predetermined shrinkage requires. The tube is removed from the lathe and is placed in a vertical position in the shrinking pit. The jacket, meanwhile, has been heated in furnaces fed with naphtha. Twenty or thirty hours' heating may be needed to bring it to a uniform temperature of about 550° F. The jacket is then lifted out of the furnace and is lowered over the tube, and goes smoothly to its seat, if all goes well, as it generally does. Hours of cooling are required to restore the great mass to ordinary temperature. Next comes the turning of the forward part of the tube, for the chase hoops, the boring of the chase hoops and the putting them successively in place. All this is a repetition of the processes described for the jacket. If jacket hoops are to be employed, the jacket now in place on the gun is turned to receive them.

The amount of shrinkage is determined by calculation based on the lowest elastic limit shown by any of the test specimens taken from each forging. Thus each gun is an individual structure as regards the tension its members are subjected to. Each forging has also its individual mark. If these are cut away in the lathe, they are transferred to another place. In the finished gun every member bears its original mark, so that each piece can be identified and its history traced.

The next operation is the finish boring of the bore and the boring out of the rear to an increased diameter to form the chamber for the powder. This is connected with the main bore by a conical portion of the bore, termed the compression slope. Back of the powder chamber is a short section of still larger diameter, termed the screw box. This has on its inner surface a female screw with sections slotted out, forming the interrupted screw for the breech plug. The short, conical portion connecting screw box and powder chamber is termed the gas check slope. The exterior of the gun is now finish-turned and the bore is rifled.

The rifling starts at a zero twist and increases toward the mouth of the piece to one turn in a distance represented by about twenty-five diameters of the bore. In the 4-inch rifle there are thirty equal grooves 0·025 inch deep and 0·279 inch wide; in the 13-inch gun there are fifty-two grooves, 0·05 inch deep and between 0·4 and 0·5 inch wide, their smallest width being at the muzzle.

The final finish of the bore is given by polishing with emery dust and oil applied with a lead lap drawn back and forth through the gun. This is done by the lapping machine, and the operation is illustrated in one of our cuts. In the same cut is shown an interesting operation; the cutting of a keyway on a threaded portion of the exterior of the gun. This threaded portion is designed to receive a brass sleeve. It is threaded in the left-hand direction. The rifling is right-handed. A tendency to left-handed rotation is imparted by the discharge as the projectile assumes its rotary motion. The brass sleeve being left-handed, the tendency of the gun under the firing stress is to screw itself more home in the sleeve. To make the sleeve secure, however, a long keyway is cut in the sleeve and on the gun. Our cut shows a portable milling machine cutting the keyway on the gun. A key is driven into the keyway when the sleeve is in place to prevent it from turning.

The gun thus far completed is now ready to receive its breech mechanism. This, consisting of relatively small pieces, has been made in the works and needs assembling and adjusting. It would manifestly be troublesome to transport a 100-ton gun to a special breech assembling shop. The work cannot be done advantageously in the main gun works. Accordingly, the opposite course is taken and the shop is brought to the gun. When a pair of guns are ready for their breech mechanism, they are run out of the shop on a railroad, are rolled off the trucks and are blocked up in a horizontal position with their open breeches facing each other, with about eight feet intervening. A small house shown in one of our cuts is then erected over the breech ends. This house comes to pieces and is transported about the yard piece by piece and erected where needed. Hooks and screw eyes are provided to hold it together. In it are placed the tools required for breech assembling and the final touch is thus given to the guns.

The working strain to which these guns are subjected in practice is limited to about 15 tons per square inch. They have been tested up to double this pressure without permanent deformation. The principal cause of deterioration is the erosive action of the powder near the seat of the projectile. This is increased by high pressure.

The following data referring to the largest gun now made for the navy are of interest:

Diameter of bore (caliber)	13 inches.
Length of gun (479·1 inches)	39 feet 9¼ inches.
Weight of gun	136,000 pounds.
Weight of full charge of powder	520 to 560 pounds.
Weight of projectile	1,100 pounds.
Velocity at muzzle	2,100 feet per second.
Velocity at 2,500 yards	1,805 feet per second.
Thickness of steel which shell will perforate at 1,000 yards distance	24·54 inches.

The New West Indian Cable.

The lack of facilities which has hitherto existed for sending cablegrams direct from England to the British West Indies, without having to pass these messages through foreign territory, has at length been removed by the extension of the Halifax-Bermuda cable to Kingston, Jamaica. This extension has just been completed, and the first messages dispatched across the Atlantic.

As some of our readers may be aware, the West Indian and Panama Cable Company has up to this enjoyed the undisputed privilege of conveying these cablegrams. The islanders disapproved of their cablegrams to the mother country being forwarded through foreign territory (the United States and Cuba), and feared the position in which they would find themselves in the event of England being at war with either of these two countries; and they also were dissatisfied at the reluctance of this company to facilitate the business of the islands by the reduction of rates, etc., and they decided some three years ago to approach the Halifax-Bermuda Cable Company with a request to extend their cable, via Turk's Island, to Jamaica, the bounty hitherto paid to the West Indian and Panama Cable Company being offered as an incentive to their doing so. This request, after some consideration and a great deal of correspondence with the imperial government, the company agreed to do, and the Telegraph Construction Company was accordingly commissioned to lay the cable, on the understanding that the work should be completed by the end of January of this year. Despite the fact that the Caribbean Sea is visited by severe storms during the winter months, the agreement has been carried through fully a fortnight before the time stipulated in the agreement, and what the English papers describe as "another link between England and her colonial offspring in the West Indies" has become an accomplished fact. The Construction Company reports that the work of laying the cable has been carried out without the slightest hitch, and that they were favored by exceptionally fine weather for the season of the year. To facilitate the laying of the cable within the time allowed by the imperial government, H. M. S. "Britannia," of the surveying department, was commissioned to perform the surveying trip, and an extensive survey of the route was made by her early in the winter. The desire of the company was to spare no pains nor expense in finding the best bed in which to lay the cable, thus lessening the fear so common in similar undertakings of being called upon in the future to make repairs to it.

Repairing Large Holes in Single Tube Tires.

Is there any sure way, says a correspondent of The Cycling Gazette, of repairing large holes in single tube tires, by vulcanizing, so that they will not bulge out at that place when the air pressure is in the tire?

In the repair of single tube tires the greatest amount of ingenuity at the command of a workman is often required. And it is in the repair of single tube tires that a wide field is open to those who care to excel and endeavor to perfect themselves in work usually thrown aside as impossible. Every day single tube tires are discarded that are still good tires, with the exception of some one bad hole which the average repairman would not attempt to fix.

In repairing any hole or cut in a single tube tire first trim the edges of the hole carefully and then cut away the rubber tread down to the canvas all around the hole and out from it each way about half an inch. Now take a small wire with a rag wrapped around one end which is loaded with gasoline, and clean the interior surface of the tire around the hole as much as possible in this manner. Cut a piece of patching rubber about three-quarters of an inch larger all around than the hole in the tire. Clean one side with gasoline and fold it up, clean side in, into a sort of cone, with the center of the piece as the apex. Push this through the hole, point downward, using a pair of plug nippers if necessary. When it is freed on the inside of the tire it will open out flat, clean side up. Be careful to hold the tire during this operation so that the patch will not drop around to the other side of the tire. Now with a small stick coat the inside of the tire around the hole with rubber solution, and when this has had time enough to become "tacky," press the tread down and pick up the rubber patch. The inner tube of the single tube tire is now patched. Take a needle and some strong linen thread, and darn the hole from the outside. Take the stitches far enough back from the edge of the hole to insure against pulling out, and be sure not to let the needle pierce the patch just put on. Do the darning as closely as possible, and see that it does not project above the level of the tread. When the darning is finished it will be strong enough to stand the air pressure, and as the patch on the inside is airtight, the rubber tread at this point will not have to stand the pressure or hold the air in. After the darning a coat of the uncured rubber solution is applied and the hollow filled with the pure gum as usual. Then vulcanize.

If the original hole be a small one, it will be advisable to enlarge it to at least one-quarter inch in diameter.

Miscellaneous Notes and Receipts.

A Resistive Resin Powder for etching purposes is prepared, according to the Photogr. Mittheilungen, by melting together over a low fire 20 grammes of resin, 60 grammes of shellac and 10 grammes of asphaltum; the colophony has to be melted first and the shellac and asphaltum are gradually added while stirring. The molten mass is poured in cold water, dried and ground as finely as possible. The shellac renders this resin powder extremely acid resisting.

Characteristics of Inferior or Bad India Ink.—Ground or liquid India ink dried in porcelain dishes should not crack, peel off, or rise in scales and should have no tinge of graphite gray or brown. Imitation India ink often smells of carbol and other antiseptic agents, sometimes even of putrid glue. Lines drawn with bad India ink can be made broader by passing a wet brush over them after they are dry; they also soon become grayish or brownish, if the rubber is used over them. Bad India ink tires the hand, and gives a grating noise in grinding and imparts color slowly. The presence of one of the unpleasant qualities enumerated suffices to characterize the India ink as inferior, but, as a rule, spurious or bad India ink exhibits several of them at one time.—Technische Mittheilungen für Malerei.

Protection Against the Tarnishing of Silver Ware.—All silver ware as well as plated goods are liable to tarnish, if not used for some time, especially if coal is burned in the house or in the neighborhood, because the sulphur contained therein blackens the silver. Entire protection from the tarnishing can be had, however, according to the Deutsche Maler Zeitung, by first slightly warming the silver and then coating it, by means of a fine brush, with collodion strongly thinned with alcohol. This coating dries at once and forms a very thin transparent as well as invisible covering, which protects the silver completely and may be removed, if necessary, with hot water. In the English stores this method has been employed for a long time, to save the silver ware in the show windows from tarnishing.

A Ship Bottom Paint consisting of seaweed, which, while green and moist, is ground in oil and mixed with litharge, lead acetate, turpentine and linseed oil, has been patented in England, says the Färben Zeitung. The coating is said to be not only a good protection against the adhering of shells, but also prevents worms from entering wooden ship bottoms or any wooden submarine constructions. The mode of manufacture is as below:

Into a certain quantity of linseed oil, say 48 liters, put ½ pound of litharge and ½ pound of sugar of lead and boil for five hours at 600° Fah. Now bring this mixture to the right painting consistency with turpentine and add ½ liter of seaweed which has been ground in oil, in the green and wet condition, as gathered on the shore. For coloring, various substances, such as ocher, etc., may be added, whereupon the paint is ready for use.

Hog's Bristles from China.—The trade in hog's bristles is one of the numerous new sources of industry which have been created in China by the opening of the coast harbors to foreign commerce, says the Zeitschrift fuer Buersten, P. u. K. Fab. During the last two decades this export has developed to such an extent that many persons are now engaged in the gathering, buying up and preparation of the bristles for export.

Formerly the bristles were worthless in China. The manufacture of brushes is still in its infancy in that country, as they are hardly known and very seldom used. If one is used, it is usually very small, and no larger than 3 to 4 square centimeters, exclusive of the handle. Brushes are only used for cleaning the cloth shoes, as the clothes are dusted with a whisk broom in China. Sometimes brushes are used for cleaning horses, but these are also small and resemble in shape and size those which are used for applying blacking. Therefore, the bristles were not considered of any value in China. When the brush maker needed some, he got them from the butcher for nothing. This has now changed. The butchers now gather the bristles and sell them.

Chinese bristles have become an article much in demand in Europe, especially the long black ones known under the name of Tientsin bristles, which are widely different from the white, short bristles coming from the South. The difference finds its explanation in the dissimilarity of the South Chinese and the North Chinese breeds of pigs. The South Chinese domestic hog is the product of careful raising. They are mostly raised for the shambles and receive a certain care as regards feeding, when it is intended to fatten them. Furthermore, the climate may have contributed to shorten the bristles and other hirsute covering. These bristles, which are mostly white, are seldom longer than 3 inches. The case is different with the domestic hog of North China. No care is bestowed upon his breeding. They run around loose on cold winter days and are mostly without shelter in the night. Therefore, they have remained very much in their primitive stage. The North Chinese hogs are black, long-bristled, scrubby animals, very much like the wild boar.

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New Coral Theory.

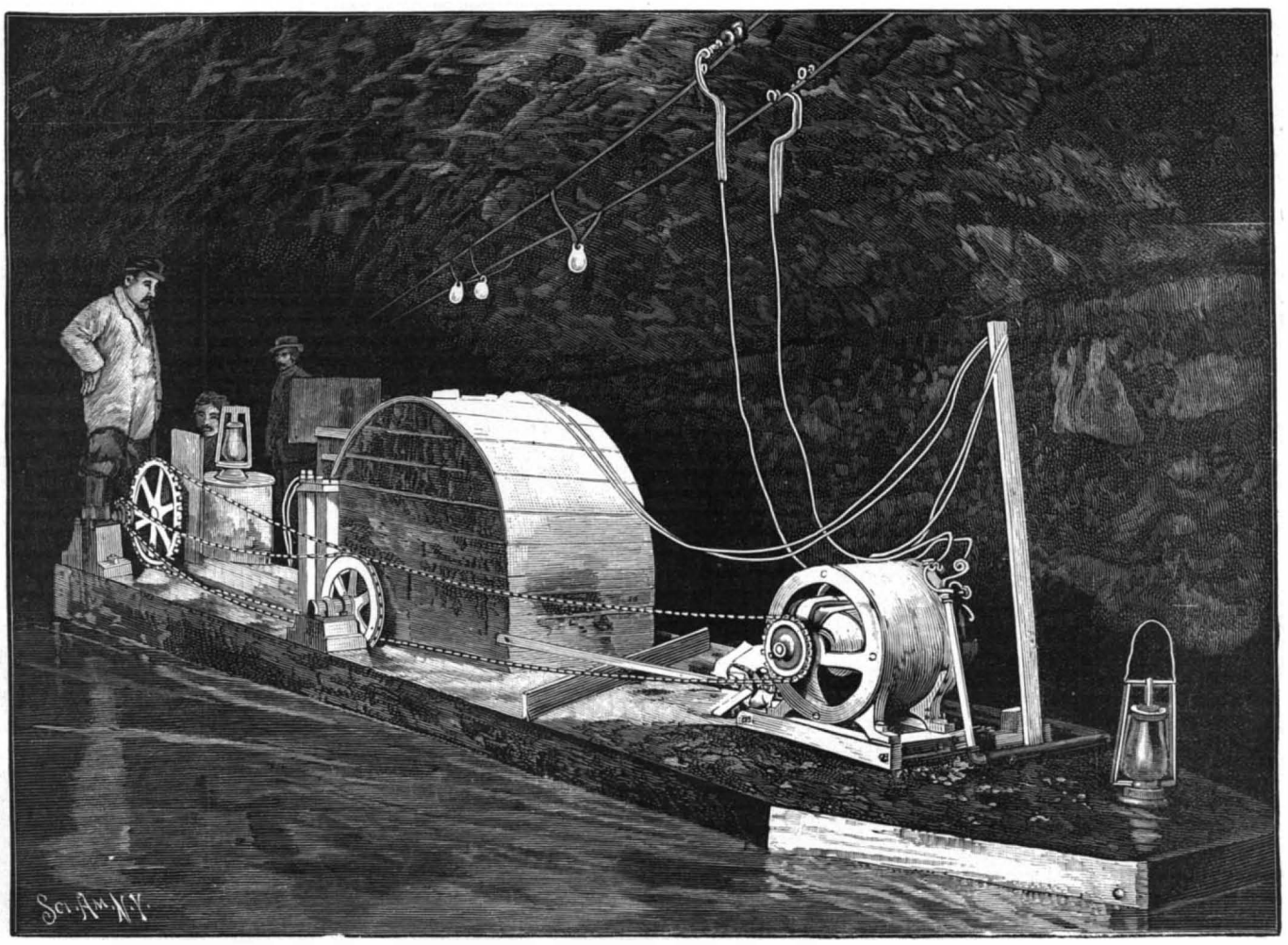
Prof. Alexander Agassiz arrived at San Francisco from Honolulu, February 12. He has spent several months in the South Sea, mainly devoting his time to the study of coral animals. Both Darwin and Dana held that coral is made, sinks and is replenished on the surface. This they taught continued indefinitely, and this process was called the theory of subsidence. Prof. Agassiz now believes that coral is a comparatively thin crust formed upon a mountain that has been submerged or upon a volcanic pile, and in nearly every case where the borings have been made the coral has been found to be shallow. In a few places where it seems to have a depth that might sustain the theories of Darwin, Prof. Agassiz proves that material into which the deep borings are made is lime of a former age of the earth. He shows that the admixture of sand with the coral establishes the surface or shallow reef. The foundation for coral in every instance has proved it to be of such material and of such shape as to warrant the conclusion that the coral is a cap to submerged mountains and volcanic upheavals.

ELECTRIC TOWBOAT IN A SEWER.

The city of Worcester has a large sewer 18 feet wide and 13 feet high. The sewage of the city is treated chemically to render it fit to flow back into the Blackstone River, so that it is desirable to separate the storm water from the sewage to lessen the expense of the chemical treatment. In order to accomplish this end a smaller sewer, 6 feet wide and 4,000 feet long, is being built inside the larger one, utilizing the bottom and one of the sides of the sewer. A cofferdam is constructed to enable the other wall of the sewer to be built, and in order to deliver materials to the workmen an electric scow was rigged up, which has been found very satisfactory. Electricity is also used to light the sewer, to operate ventilating fans and to work electric pumps. All of the lighting and power are generated on the premises in a small building outside the sewer. About midway between the ends of the sewer a small dock has been constructed and the materials are delivered to it by an incline through a hole made in the top of one wall.

The towboat is a catamaran 22 feet long and 5 feet wide. Each of the small boats is 18 inches wide. In the middle of the catamaran is a small paddle wheel box which is to prevent splashing. This is driven by means of sprocket wheels and chains which are connected with an electric motor of 2½ horse power. At the stern end is a rudder and controller, so that one man can operate both. Only one electric boat is used. It tows six scows, which have already handled 12,000 bricks, 50 barrels of cement and 100 barrels of sand daily. The double trolley system is used, the wires being hung from insulated brackets secured to the top of the arch in such a way that a trolley can be run on it. A scow is also fitted with a centrifugal pump which is used for pumping out the cofferdam, and it is driven by another motor of 14 horse power. The application of the electric towage to sewer construction is novel and the results obtained are most satisfactory.

The electric scow was designed by Mr. Harrison P. Eddy, Superintendent of Sewers, Worcester, Mass. Mr. Robert N. Kendall is the assistant in charge of the electrical work.



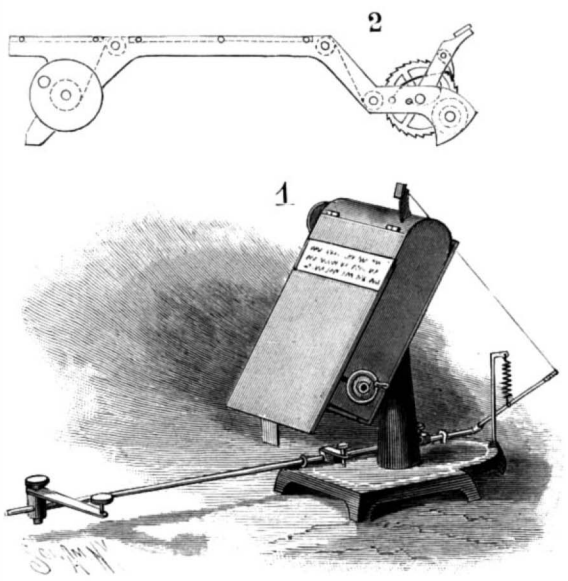
ELECTRIC TOWBOAT IN MAIN SEWER, WORCESTER MASS.

The X Rays in the Silk Culture.

The masculine silk cocoon yields more silk than that of the feminine; hence for raising purposes such varieties as give more masculine eggs are by far preferable. Up to the present it was not easy to distinguish the masculine from the feminine cocoons; the distinction was solely based on the greater weight peculiar to the feminine cocoon. The X rays have greatly facilitated the distinction. On account of containing the unripe eggs rich in mineral salts, the hind part of the feminine cocoon is found to be by far less transparent than that of the masculine. The dark shade in the vicinity of the ovary admits of readily recognizing the feminine silk chrysalis.

AN IMPROVED COPY-HOLDER.

The accompanying illustration represents a copy-holder designed to facilitate the taking of notes, and afterward holding the paper on which the notes are written in convenient position for transcribing, the paper used being in the form of a continuous web. The improvement forms the subject of a patent issued to Elmer E. Paxton, of Honolulu, Hawaii. Fig. 1 represents the device in use. Fig. 2 showing a view of one side of the paper-carrying frame, which is held in a sheet metal casing, with a cover plate that is movable to provide a large or small space for the writing, the paper being advanced by a lever or by thumb wheels as desired, and the plate affording a rest for the arm. For conveniently retracting the web when the notes are to be transcribed, means are employed in connection with a base on which is a column carrying a flanged supporting plate on which the casing of the paper-carrying frame rests. In bearings on the base is a rock shaft on whose forward end is an arm adapted to extend near the keyboard of the typewriter, while the opposite end of the shaft carries an arm to which is attached a retractile spring, and which is also connected by a cord with the free end of a lever projecting from the upper end of the casing, so that by rocking the shaft extending forward from the base the web is advanced to expose the copy to the typewriter. When the web of paper has been filled with writing, the web should be wound back to the first position before the copying or transcribing can be done.



PAXTON'S COPY-HOLDER.

Sensationalism, not Science.

Scientific discoveries . . . have often been so wonderful in character that it ought not to excite surprise to find intelligent people ready to accept without question announcements of inventions and discoveries of the most improbable and absurd character. Along this line the evil influence of a sensational press is enormous. It was bad enough ten years ago, but it has been greatly magnified by the recent, and, on the whole, unfortunate cheapening of processes of illustration, to the seductions of which nearly every newspaper in the land has yielded.

To this has been added the newspaper "syndicate," by which men who know really nothing of science are employed to furnish sensational articles on scientific discovery, illustrated by sensational pictures, all of which is the more injurious because often founded upon a slender, microscopic tissue of fact. Unfortunately, some men who may be said to inhabit the fringe of genuine scientific activity lend themselves to this sort of thing and are made much of accordingly.

Whole pages of this modern journalism are filled with accounts of discoveries that are going to be made, for writers of this class are shrewd in taking advantage of the fact that human interest and human memory are now practically restricted to about twenty-four hours in time. The publication of a broadside describing an alleged improvement of the telescope or microscope, in which there is absolutely nothing new that is true or true that is new, adorned with a series of cuts largely imaginary and many of which have no relation to the subject matter, has served the purpose intended when its author has received his pay from the "syndicate" and when the syndicate has scored a triumph in what in these days is called "enterprise."

Even the most conservative among men of science are made to appear as willing purveyors of sensationalism by what ought to be looked upon as an unwarranted and illegitimate use of the results of carefully conducted investigations, often before such results have received final construction and approval at their own hands.

If all impressions made by this false popularization of science were to disappear in twenty-four hours, the evil would be greatly lessened; but, unfortunately, there are many very intelligent and thoughtful people, who ought to constitute the best support of scientific work, upon whom they are more lasting. To such the line separating the genuine accomplishments of honest scholarship from the output of sensationalism, which ought to be clear and sharp, is becoming very nebulous, and there is imminent danger of a revolt against the whole thing.

The extent to which credulity has been carried was beautifully illustrated not long ago when a widely known scientific man amused himself and many friends by caricaturing, in the columns of one of our standard scientific journals, some of the phases of modern psychophysics. So perfectly did the burlesque reflect the form and substance of some recent contributions to that science that it was immediately accepted as serious by the large majority of readers.—Prof. T. C. Mendenhall, in Science.

THE work on the middle arch of the Bonn Rhine bridge, which is at present the largest in Germany, being 184 meters wide, is now completed. The result of lowering the enormous iron burden of 1,700,000 kilogrammes upon the bridge piers was looked forward to with great expectation. The same has turned out surprisingly favorable, for the two piers only show a lateral displacement of 3 millimeters, which furnishes the best testimonial for their construction. The arch has settled 35 millimeters in the upper edge.

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Forms of Lightning.

In his meteorological essays Arago collects and classifies the descriptions of the different forms that lightning assumes. The first class consists of narrow, thin, sharply defined, luminous lines which may have crimson, violet or bluish colors. These lines may be classified as straight or slightly curved, zigzag or broken lines, greatly curved and even re-entrant, and, finally, forward and return, very nearly resembling the capital letter V. We have also single flashes that bifurcate into a collection of smaller flashes that may number anywhere from two to one hundred, the double and triple forks being least frequent. To these varieties the editor would add a sinuous form of lightning flash that he has seen on several occasions, both in Chicago and Washington, in which the flash appears to run with comparative slowness, horizontally, along the under surface of a cloud, dying out after it has pursued a path whose apparent angular length is from one to five degrees. No noise whatever usually accompanies this lightning, although the flashes may be in the zenith. When last observed, in May, 1897, it seemed possible that these might be simply long flashes viewed endwise, so that the apparent path, which was sometimes so curved as to form a complete oval or spiral, was simply the projection of what would from another location have appeared to be a long flash between an upper and a lower cloud.

The second class recognized by Arago is that of the diffuse lightning, spreading over immense surfaces, often of an intense reddish tinge, but sometimes blue or violet, and which in America and England are spoken of as "heat lightning," but which are more properly called "sheet lightning." During an ordinary thunderstorm the sheet lightning is far more frequent than the flash lightning.

The third class includes the mysterious "globular or ball lightning," which rolls about on the ground and has thus far defied all attempts at satisfactory explanation.

As a fourth form of electric discharge we must reckon the continuous emission of light from the surface of certain clouds. As these clouds are low, and as the light dies away after a few minutes only to be renewed again after a short interval, we must consider this light as due to myriads of little flashes between the particles of the clouds without appreciable noise.

Besides the lightning interchanged between the clouds or the clouds and the earth in ordinary weather, a still more interesting fifth class should be made of those that play between the earth and the cloud of ashes and vapor formed above a volcano in active eruption.

There does not seem to be any evidence that in these five classes there is any special new production of electricity. We have only to consider the earth as the electrified body, permanently electrified, and always, by induction, inducing electric manifestations in every substance that is near to it. The auroral light ought to be included as one form of the lightning discharge, since it is certainly a form of electric discharge modified by the rarity of the upper atmosphere from the flash to the stratified sheet lightning. The electric discharge is modified, not merely by the rarefaction of the dry atmosphere of oxygen and nitrogen, but still more so by the rarefaction of the other gases in the atmosphere, such as the hydrocarbons and the carbonic acid gas, and probably also by that of the aqueous vapor, so that air which is very dry or very cold, and therefore contains but little aqueous vapor, may have much to do with the formation of auroras. According to the recent researches of Prof. Trowbridge, the character of the electric current as to intensity and quantity is also a prime factor in determining the character of the luminosity. He has been able to reproduce a great variety of forms of lightning, such as have been photographed from time to time, by proper alterations in his apparatus.—Prof. Cleveland Abbe, in Monthly Weather Review.

Cavalry in Future Wars.

It has been said that the days of dashing cavalrymen will soon be over, and that the art of riding will become as purely a pastime as the art of sailing is destined to become by reason of the introduction of steam, says The Literary Digest. This opinion is combated very vigorously by Major Kunz in his Kriegs-Geschichtliche Beiträge. He believes that the uses of cavalry have been changed, but that its existence is not yet endangered. On the other hand, he points out that mere mounted men, as against highly trained riders under the very best leaders, are absolutely useless to-day. Commenting upon the many brilliant though unfortunate cavalry attacks executed by the French in 1870, he says:

"1. A frontal attack of cavalry against victorious infantry can only be justified when the aim is to save time for the purpose of saving the beaten army. The success of such an attack is practically impossible.

"2. Momentary success of an attack against the flank of victorious infantry is possible. But even such an attack must end in the destruction of the force which undertakes it.

"3. If the enemy's infantry is beaten, cavalry may be used to advantage. But it must be faultless cavalry, led by faultless, courageous riders, men who are also perfect in their knowledge of the history and psychology of war. In such a case no thought must be given to a few hundred horses foundering on the field. The enemy's infantry must not be given time to assemble. The cavalry must endeavor to head off the fugitives, for the most disheartened of them will lead the stampede. In the rear of a flying army are always the bravest. It matters little whether the enemy loses much in killed and wounded. The question is not how to kill men, but how to discourage them, to rob them of their leaders, to destroy their organization.

"An infantry which has suffered heavy losses, but has advanced victoriously, and has still sufficient ammunition, may laugh at a cavalry attack. An infantry that has been beaten, and whose officers are killed, and which has lost courage in consequence, is a ready prey for enterprising cavalry. It will be said that, in such a case, the cavalry of the beaten army must sacrifice itself for the infantry. Quite true. The task of the attacking cavalry will then be to overthrow the horsemen of the vanquished army. If this succeeds, the stampeded horsemen will only assist in increasing the confusion of the flying infantry.

"At any rate, a few hundred men and horses dying of sheer exhaustion in the pursuit of a beaten enemy will save the trouble of another bloody battle. To train the cavalry for such work is the purpose of extensive maneuvers."

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RECENTLY PATENTED INVENTIONS.

Engineering.

GAS ENGINE MUFFLER.—Charles S. Bird, Jackson, Mich. This device comprises a casing in which is suspended a vessel into which projects the exhaust pipe from the engine, a conical spreader being supported immediately below the exhaust outlet, and there being ample room for the gases to expand in the vessel, while a U-shaped pipe is provided for the escape of the gases to the outer air.

SPEED-CHANGING DEVICE AND INDICATOR.—Philip J. Runser, Redfield, S. D. This is a device for use on traction and other engines, to indicate the speed while the engine is running and to permit the engineer to readily change the speed at any time as desired. The device is more especially designed for use on engines employed for thrashing and similar purposes, and connected to the governor stem is one end of a spring whose other end is connected to a double gear wheel for adjusting the tension, the gear wheel being normally stationary, an operating device engaging one of its series of teeth while an indicator is operated by the second set of teeth. The speed of the engine is changed by increasing or diminishing the tension of the spring.

WATER WHEEL.—David Morgan, Axial, Col. To facilitate raising and lowering a water wheel, and holding it immersed as desired, is the object of this invention, according to which the wheel is carried at one end of a pivoted frame at whose opposite end is a rack and pivoted levers, one lever having a dog and the other a pawl, both arranged for engagement with the rack, the pawl and lever holding the frame in its adjusted position, and the dog and lever being adapted to raise the wheel and assist in lowering it, and the weight of the frame enabling the levers to be easily operated in raising and lowering the wheel.

BOILER ALARM.—John O'Connor and Collatinus A. Turner, New York City. According to the system provided by this invention, an electric alarm or steam whistle alarm may be employed to indicate high or low water, the device comprising a cylinder with water gage and float from which extends a stem connecting with a shaft carrying an arm to which is attached a yielding contact plate, in connection with an electric circuit, while there is also a spring yielding connection between the arm and a water controlling valve, which is operated by an upward or downward movement of the float.

Electrical.

CALL BOX SYSTEM.—William T. Budds, Charleston, S. C. This system comprises a main wire with which the call boxes have a shunt connection while also having a ground connection, a battery with one pole of which one end of the main wire connects and a wire leading from the other pole of the battery and connected by a switch with a ground wire, a switch also connecting the last wire with the main wire. The first switch also operates to connect the ground wire with an intermediate element of the battery, and there is a sounding device at each extremity of the main wire. The improvement contemplates a single wire open main circuit having a single wire connection with each call box, the circuit being completed through the ground.

Bicycles, Etc.

VARIABLE GEARING.—Samuel J. Evans and Harry H. Huggins, Roanoke, Va. To enable the rider to readily vary the speed of his machine while the latter is in motion is the primary object of this invention, according to which there are a number of concentric gears on the pedal shaft, while a longitudinally grooved shaft at right angles has its rear end geared with the drive wheel, there being a number of loose pinions on the forward end of this shaft to mesh with the gear of the pedal shaft. Separators are arranged between the pinions, the pinions and separators having keyways, while a key sliding in the groove of the shaft is adapted to be moved into engagement with the ways of the pinions or separators.

TANDEM.—Henry M. Hunt, Indianapolis, Ind. This invention provides a construction whereby two bicycles may be easily connected to form a tandem or disconnected and employed as independent bicycles. There is a yielding connection for a leader and trailer, comprising crossheads, one adapted for pivotal connection with the leader and the other with the trailer, while plates having telescopic or tubular portions are mounted to move between the crossheads, and rods extend from the crossheads to connections with the plates. Both the leader and trailer may have one or more seats, or one seat may be omitted and provision made for carrying bundles.

BICYCLE STAND.—William E. Leavitt, New York City. According to this invention, a bicycle stand of strong and inexpensive construction is formed of a block of wood, on a suitable base, a forward inclined groove receiving the front brace, while a transverse groove receives the crank hanger and another groove receives the rear fork. The block is made high enough to hold the wheel free from the ground, permitting the wheels to be revolved and all parts readily reached for cleaning and repairing, and it may also be made sufficiently strong to support the rider while being fitted to the saddle.

Mechanical.

BLANK FOR MANUFACTURING HOLLOW BODIES.—Carl Meyer, Dortmund, Germany. In making seamless hollow bodies from plates or sheets, this invention is designed to facilitate doing the work without materially altering the original distance of the particles of material in a radial direction or in a direction outward from the central portion of the blank. With this view the portion of the blank designed to come directly under the mandrel is made with a marginal portion which for a predetermined distance increases in thickness in such proportion that the area of concentric cross sections at any distance apart from the center of the plate shall be constant, the thickness of the blank at different points being such as would be produced by stretching the finished tubular article into a substantially plain article.

ECCENTRIC.—Casper E. Anderson, Castle Dale, Utah. This invention is for an eccentric which may be reversed by shifting, and is adapted for engines and similar machinery employing slide valves. A sleeve splined on a shaft is inclosed by and has screw-threaded connection with a second sleeve, a boss keyed to the shaft serving to guide the second sleeve as it turns, while an eccentric pivoted to the plate has connection with the second sleeve, the eccentric having an elongated opening to receive the boss of the plate to permit the adjustment of the eccentric.

CASING CUTTER FOR WELL TUBES.—Silas W. Munn, Mannington, West Va. When the iron tubes or casings of artesian or driven wells are to be cut for removing a section, and it is desirable to make the cut near a joint or coupling, this invention provides a device to automatically indicate the location of the joint and at the same time arrest the descent of the cutter at the right point for dividing the tube or casing. Attached to an upper or lower extension of the rotatable tube cutter is a beveled catch and a spring which projects the device laterally for engagement with the joint of the tube or casing, the device holding the cutting apparatus in proper working position.

Agricultural.

CULTIVATOR.—Frederick H. and Thomas C. Bornman, Summit, Miss. In cultivators or side harrows, this invention provides a means whereby the angle, pitch and spaces or distances of all the blades can be simultaneously adjusted, to secure complete arrangement and exactness in relative position, it being possible to retain the equalizing cross bars to which the shanks of the blades are attached transversely to the beam or at any desired angle. The invention also provides for the use of any form of blade, whether it be a turning plow or a half shovel, either being readily secured to the shanks or stocks and given any desired inclination, the attachment being effected by a shoe and a single fastening bolt and being absolutely rigid.

POISON OR FERTILIZER DISTRIBUTER.—Frank L. Richter, Moravia, Texas. For the distribution of poison or a fertilizer to the plants at each side of a furrow through which the machine may be drawn, this invention provides a machine of simple and inexpensive construction, the frame of which carries a fan near the outlet of the poison or fertilizer receptacle, the valved outlet of which is in communication with an adjusting distributing device consisting of a T-shaped tube, open at the ends of its transverse section, the fan and blower being operated by the revolution of the axle carrying the supporting wheels.

Miscellaneous.

CLOCK.—Sigismund B. Wortmann, New York City. This invention relates to clock-driving mechanism to run with but little friction and take up only a small space, whereby a clock may be run for several years and keep accurate time. The mechanism may be connected to an ordinary one-day clock, enabling the clock to run for a year or more with one winding, and comprises substantially a spring motor, such as covered by several former patents granted to the same inventor, but modified by the addition of certain parts and the substitution of other parts.

ACETYLENE GAS GENERATOR.—James L. Hardwick and Sidney O. Manville, Cedar Rapids, Ia. This generator comprises a rising and falling holder in which the receiver is supported to carry the carbide into and out of contact with the water, a gasometer to hold the gas being connected with the holder by a pipe, and there being an intermediate mechanism whereby the movement of the dome of the gasometer will operate to control the up and down movement of the holder, whereby only the required amount of gas, as taken off for consumption, will be generated.

EARTH AUGER.—Joseph Carter and William Richmond, Blyth, Canada. A tool for conveniently boring post holes, devised by these inventors, comprises a telescopically adjustable handle with spider-shaped foot piece carrying blades curving inwardly, and attached to a vertically adjustable ring, to regulate the stiffness of the lower ends of the blades, the blades forming a skeleton basket in which the earth is received as the auger is rotated and forced down, and the loose earth being thus removed as the operation progresses.

WHIP SOCKET AND REIN HOLDER.—Marshall T. Howland, Pittsford, Vt. This is a combination device for attachment to the dashboard of vehicles and has two pivoted members arranged to hold the whip and a supplemental member to hold the reins. Two clips are rigidly secured to the whip socket, along which extends a rib, and a post stands rigidly on the upper clip, from which projects a stop, while a spring embracing the post serves to throw a shoe toward the rib.

SAFETY DEVICE FOR ENVELOPES.—Aaron H. Danner, Manheim, Pa. To prevent the fraudulent opening of envelopes by steaming or otherwise, this invention provides for the cementing of a piece of material to the inner face of the envelope adjacent to the address, such material being covered by the sealing and not being liable to be loosened without blurring the address. Another form of the improvement provides for an inner and outer envelope, the sealed side of the inner envelope being cemented to the back of the address portion of the outer envelope.

COFFEE ROASTING.—John W. Pinkerton, Zanesville, O. This invention covers a method and apparatus for roasting coffee, the apparatus comprising a roasting furnace in which is a coffee cylinder having a hood or cover with an opening, a burner being movable into and out of the opening, whereby a gas flame may be introduced at intervals as the roasting proceeds, the method being to subject the roasting coffee to the intermittent action of direct flame and thus insure a more immediate evaporation of its moisture.

SPRINKLING NOZZLE.—Arthur W. Joy, Bangor, Me. This nozzle is designed for sprinkling roadways, lawns, etc., and to be connected with underground pipes, the top of its body being rounded to lie flat on the curbing or project slightly therefrom, so as not to obstruct travel. It has a central water supply chamber communicating by ports with outer flaring sockets in which are conical hollow heads, each provided with a series of outlets, a seat being formed at the smaller end of each head for a ball valve, while the outlets form spraying passages or ways around the ball.

WHIST TABLE.—William P. Morrissy, Brooklyn, N. Y. This inventor has devised a table especially adapted for duplicate whist, in which the hands

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played at each table will remain on the table in proper order for the duplicate play. The table has a stationary square top, below which is a round revoluble top in which, at four equidistant points, are card-receiving receptacles, the round top being of a diameter about equal to the greatest diameter of the square top, whereby the portions carrying the card receptacles will project beyond the four sides of the square top. Means are provided for locking the revoluble top against rotation.

HEATING STOVE.—Cornelius Barnhart, Walker Valley, N. Y. In the ash pit of this stove is a number of fire pots, supported from the top of the ash pit, there being a combustion chamber into which the tops of the fire pots open, and a feeding magazine adapted to convey fuel to all the fire pots automatically, although the construction is such that, when but a small amount of heat is required, but one of the fire pots may be employed. Heat-radiating flues lead from the combustion chamber into a hot air chamber, from which a draught flue leads to a point of discharge, the stove being designed to afford high efficiency and be very economical of fuel.

WINDOW BRACKET.—Silas G. Dean, Norfolk, Neb. This bracket is designed especially for use as a scaffolding for persons cleaning windows, being readily adjustable to windows or openings of different sizes, and easily made secure in position. It has a body portion consisting of binding strips made in adjustable sections and connected by clamping devices, a platform being adjustably supported by the binding strips, while an adjustable support is hinged to the outer end of the platform, for which also a locking device is provided.

KETTLE RACK.—William C. Donica, Grayson, Ind. To facilitate suspending one or more kettles over a fire, for outdoor use, this invention provides suitable uprights, not liable to become unduly heated and which may be readily set up, and from which the pots may be easily suspended, the pots being directly connected to clamps adjustable upon the uprights or standards of the rack, and locking themselves thereto automatically.

WASHING MACHINE. — Samuel Hartridge, Huntington, N. Y. This invention relates to machines adapted to be attached to an ordinary tub, and consists of a bar clamped at its ends to the sides of the tub, while in the center of the bar is journaled a shaft on whose upper end is an operating crank and on the lower end a rubbing wheel. The ends of the bar are pivoted to clamps of peculiar construction which engage the sides of the tub, the device being adjustable to tubs of different sizes, and in operation the wheel, which is furnished with slats or ribs, is designed to rest directly upon the clothes and keep them beneath the water.

NAPKIN RING AND HOLDER.—John S. and William W. Hoagland, Long Branch, N. J. This device is made in detachably connected sections, each section being provided with a fastening device adapted for application to the clothing of a person and a holder for the napkin, whereby the ring may be utilized to hold the napkin in front of the person. When the sections of the ring are locked together, pendent members prevent the ring from rolling

CURTAIN HOLDER.—Ulysses S. Parish and Flavel A. Rudolph, Carmi, Ill. This holder is arranged to permit of conveniently and quickly moving the ordinary spring roller carrying the curtain up or down on the window, permitting the unscreening of the upper portion of the window while the lower portion is screened. Upon a centrally depending rod is a longitudinally adjustable support having a slotted plate in which an adjustable frame for the curtain roller may be held in adjusted position, the device being of simple construction, easily manipulated and not liable to get out of order.

CAME.—Christopher C. Tracy, Brooklyn, N. Y. This invention relates to latticed or stained glass windows, and provides useful improvements in lead cames whereby a pane is securely united with the came to prevent rattling and to render the joint between the came and pane waterproof. The came is formed at the inside with recesses or grooves for the reception of cement or other binding material to hold the pane securely in place between the flanges, the recesses being formed at the time the came is produced in the lead press.

Designs.

CARPET.—Eugene A. Crowe, Brooklyn, N. Y. Three carpet designs have been patented by this inventor, in one of which the main figure is a rosette comprising a floral center and foliate fringe, there being opposing triangular groups of leaves and irregular checkering, with scrolls. Another design comprises a fanciful composite figure of floral center piece and border of palm scrolls, with leaf scroll decorations, while a third design has an irregular checkered background upon which a main figure represents a branch with leaves, the leaves apparently resting on other larger and shadowy leaves.

KNOB FOR VESSELS.—Cæsar A. Cuppia, New York City. The leading feature of this design consists in a stag crown, the shank being reduced relatively to the crown, the back of which is roughened to simulate a stag horn.

CONDIMENT HOLDER.—This is a further patent of the same inventor, the design representing the crown of a stag horn, as a body, framed by a top and base, the holder being adapted for all kinds of handleless vessels.

FRAME FOR SPOOLS OR REELS.—August Scherrer, Biegel, Texas. This design provides a device designed to facilitate holding and handling spools of wire, the trunnions of the spools being received in apertures in the ends of a forked portion of the device, the other end of the frame of which is provided with two handles.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7358) H. P. R. asks: Would an engine 3×4; revolutions, 500; steam pressure, 100 pounds; give power enough to run the dynamo described in SUPPLEMENT No. 600? A. This engine should have ample power. It will be necessary to use a pulley 3⅜ times as large on the engine as on the dynamo to bring the speed up to 1,800 turns per minute.

(7359) A. J. M. asks for some means to remove frictional electricity from a pile of paper that is just printed. A. There does not seem to be any better mode of preventing the electrification of paper in running through the press than to dampen it with water. The paper is thus made a fairly good conductor and the electric charge is dissipated.

(7360) T. S. asks (1) if the motor described in SUPPLEMENT, No. 641, can be changed into a dynamo, and how. A. The motor in SUPPLEMENT, No. 641, may be run as a dynamo by applying power to the armature. 2. I wish you would also state what kind of a battery and how to make it as a plunging battery. A. The plunge battery is fully described in SUPPLEMENT, No. 792 (price ten cents); so that any one can make it from the drawings there given. 3. How are the filaments in incandescent lights made, and from what material? A. The filaments of incandescent lamps are made of vegetable fiber, formerly of split bamboo, but now of cellulose or something of that sort prepared chemically from vegetable material. The process is a long one. The principal change is produced by heating it for a long time in a red hot iron box in a furnace where the fibers are carbonized.

(7361) F. G. G. writes: A says that crystals of ice form at the bottom of a body of water and rise as crystals to the surface and are then massed in a sheet of ice. This has reference to a small fresh water lake or pond. B says that this is not the process of the freezing of ice. Please say who is right, A or B. A. B is right. The water toward the bottom of a fresh water lake in winter is at 39° Fah. Water colder than 39° is lighter than water at 39°, and therefore the colder water floats on the warmer. Ice can form only in water at 32°, and water at this temperature can only be found on top of the water at higher temperature. Hence ice forms on the surface. This is true of all ice excepting anchor ice, the formation of which it is difficult to explain.

(7362) "Old Reader" asks: Will you very kindly give in Notes and Queries a recipe for a furniture renovator and polish? Something that can be used on pianos, furniture and all polished or varnished surfaces, a polish that will dry hard and not be sticky. A. Formulas for excellent furniture polishes are given in our SUPPLEMENT, Nos. 1067, 1099, and 1145, price 10 cents each by mail.

(7363) I. D. asks: 1. Have you a SUPPLEMENT which contains a good article with diagrams on building a canvas canoe? If so, will you let me know through your Notes and Queries? A. Full details for the construction of a canvas canoe are given in SUPPLEMENT, No. 216, price 10 cents by mail. 2. What wood do you advise for the ribs of a canoe? A. Use oak.

(7364) Since replying to query 7329 we have received from a manufacturer a sample of "boiled out" linseed oil. Excepting for a slight odor it bears no resemblance to linseed oil. It is a solid, noninflammable, nearly fibrous and elastic like a sponge. We are not informed as to the article, except as to its name, which seems to be a trade name. Its insulating qualities would be no greater than those of air, since air fills its pores, and it has been proved that porous insulators are pierced as easily as the air. It could not be used to separate the layers of a coil nor to immerse a coil in. All liquid insulators fill the spaces of the coil and are continuous. If a spark ruptures them, they close again instantly and are as strong as before.

(7365) W. F. R. writes: As a core for a choking coil I use an iron pipe, into which other and smaller pipes may be inserted. These pipes soon become inconveniently hot. Would slitting the pipes longitudinally diminish the heat sufficiently to repay one for the trouble of doing it? Does the unslit pipe really waste much energy, and about how much? Would the slit pipe choke more, and about how much more? If you need data they are these: Length of coil 18 inches, diameter of core 2 inches, volts 106, amperes about 8, 300 turns of No. 12 wire in 2 layers. A. The object of a choking coil is to offer a counter-electromotive force. The only energy which is lost is due to the ohmic resistance of the wire and the core losses, which can be made very small. Make your core of a bundle of No. 18 best annealed Norway iron wire. Slitting your pipes would help your case a little, but not enough for your purpose.

(7366) H. T. W. asks (1) where to get information how to make a direct current dynamo that will produce as small a current as 10 to 15 volts. A. The band dynamo described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, has about 3 amperes at 12 volts when run at full speed. You could attach a motor to it with little trouble. Croft's "How to Make a Dynamo," 80 cents; Halliday's "Small Dynamo," $1, are both for amateurs. 2. Can the little alternating dynamo mentioned in SCIENTIFIC AMERICAN of November 11, 1897, be changed (from the directions given) so as to produce only 10 or 12 volts instead of 150, as stated? More than 12 volts will heat up the fields of the magnet too much. A. You would have to charge the fields of the alternator by battery and would be no better off than at present. We think you will have less trouble with your battery than with more complicated machinery.

(7367) L. & B. ask: 1. By using a transformer could we cut a 110 volt current down to about 10 volts? A. If the current is alternating, it can be changed by a transformer from 110 volts to 10 volts, but if the current is direct, a rotary converter must be used. 2. Would 10 volts give a large enough spark to explode gasoline in a gasoline engine? A. Yes. 3. Where could we have one made? A. Consult our advertising columns or some electrical engineer in your vicinity.

(7368) A. S. asks: 1. Where can I get miniature accumulators such as described in SUPPLEMENT, No. 842? A. Consult our advertising columns. 2. Can I charge 52 of them on a 104 volt lamp circuit? A. Accumulators are charged at a pressure of 2½ volts each. At this rate 42 could be charged on a 104 volt circuit.

TO INVENTORS.

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FEBRUARY 15, 1898,

AND EACH BEARING THAT DATE.

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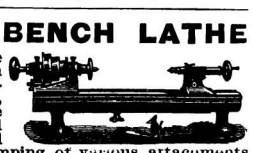

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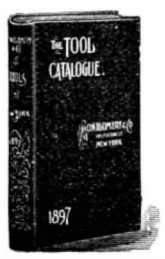

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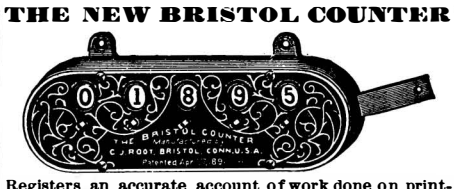

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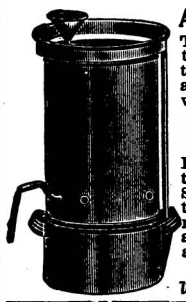

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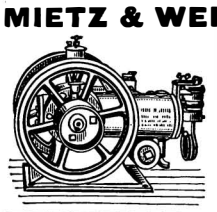

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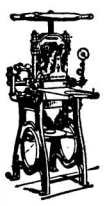

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